

Harold Ellis.
7-17-43

Aircraft
**INSTRUCTIONAL CHARTS
ALLISON ENGINES**



STUDENTS
PRELIMINARY
INSTRUCTION MANUAL
ASC-1M-17

★ **U.S. ARMY AIR FORCES • AIR SERVICE COMMAND** ★

7-17-23

ALLISON ENGINES INSTRUCTIONAL CHARTS



STUDENTS

PRELIMINARY

INSTRUCTIONAL MANUAL

1923

ALLISON ENGINE COMPANY

INTRODUCTION

The color charts are for the instructors' information, and to teach the Aircraft Engine Mechanic by coloring the black and white charts with aircraft designated colors. It shows the flow of liquids, the placement of equipment, and their relation to other parts of equipment and places in the minds of the mechanics, so that he may recognize at a glance, the colors used in marking of aircraft tubing.

Reference United States Army Specifications, No. 98-24105 O and No. 98-24105 P.

E-13. Marking for Electrical Connections. - The following warning shall be placed at the points where it is necessary to break electrical connections when folding back or removing wings:

“CAUTION: DISCONNECT ELECTRICAL WIRING BEFORE REMOVING WINGS.”

E-14. Marking for Engine Controls. - All engine control units shall be clearly marked in the vicinity of the lever referred to, and in such a position that the lever and marking association is clear, as follows:

<u>Control</u>	<u>Extreme Positions</u>	
Throttle	Open	Closed
Mixture	Rich	Lean
Shutter	Open	Closed
Carburetor Heat	Hot	Cold
Propeller	Low RPM	High RPM
Supercharger (if turbo)	On	Off
Supercharged (if 2-speed geared)	High	Low

In marking the control levers, the abbreviations T,M,S,P, and B, may be used for the throttle, mixture, shutter, propeller, and supercharger levers, respectively.

E-15. Width of Marking Band. - The width of each color in the marking band shall be approximately 1/2 inch.

E-16. Marking for Fuel Lines. - All fuel lines shall be marked with a band of red paint near each union and on each side of every flexible connection.

E-17. Marking for Oil Lines. - All oil lines shall be marked with a band of yellow paint, near each end.

E-18. Marking for Cooling System. - All piping, used in the cooling system shall be marked near each union and on each side of every flexible connection as follows.

E-18a. Water. - A band of white paint.

E-18b. Prestone. - A band of white paint on each side of a band of black paint.

INTRODUCTION

(Cont'd)

E-18c. If the engine is cooled with any liquid except water, the cowl or structure near the filler unit shall be marked with letters not less than 2-1/2 inches in height designating the cooling liquid required. For prestone cooling, the word "PRESTONE" shall be used and the letters shall be black on a white background.

E-19. Marking for Fire Extinguisher Lines. - All fire extinguisher lines shall be marked with a band of brown paint, near each end.

E-20. Marking for Flotation Equipment Lines. - All piping used in flotation gear installation shall be marked with a band of light blue paint, near each union.

E-21. Marking for Oxygen Lines. - The oxygen lines shall be marked with a band of light green paint, near each union.

E-22. Marking for Air-Speed Lines. - The pitot or pressure line shall be marked with a band of black paint on each side of all union connections.

E-23. Marking of Manifold Pressure Lines. - Manifold pressure lines shall be marked with alternate bands of white and light blue, near each union.

E-24. Marking for Vacuum Lines. - Vacuum lines shall be marked with alternate bands of white and light green, near each union.

E-25. Marking for Hydraulic Pressure Oil Lines. - The hydraulic pressure oil lines shall be marked with bands of light blue on each side of a band of yellow. Markings to be near the unions.

E-26. Marking for Compressed Air Pressure Lines. - The compressed air pressure lines shall be marked with alternate bands of light blue and light green, near the unions.

E-27. Marking for Steam Lines. - Steam lines shall be marked with alternate bands of light blue and black, near the unions.

E-28. Marking for Purging Lines. - Purging lines shall be marked with alternate bands of light blue and yellow, near the unions.

E-29. Marking for Exhaust Analyzer Lines. - Exhaust analyzer lines shall be marked with alternate bands of light blue and brown, on each side of union connections.

E-30. Marking for Radiators. - A data plate, Drawing No. 0153316-14 shall be soldered to the radiator and located where it may be easily read when the radiator is installed on the airplane.

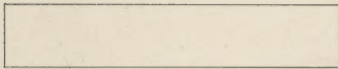
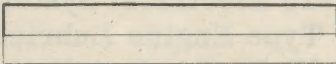
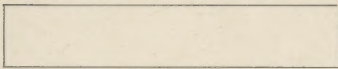
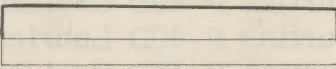
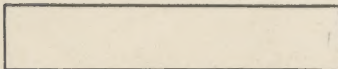
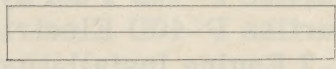
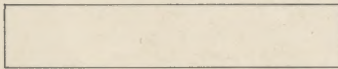
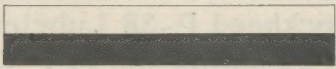
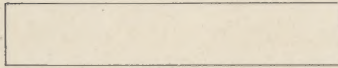
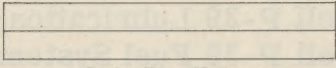
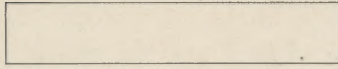
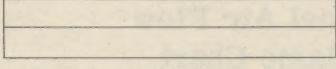

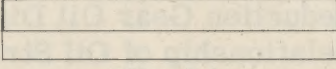
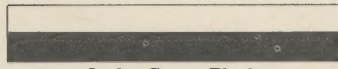
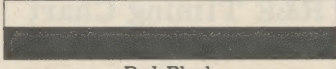
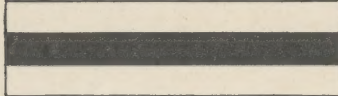
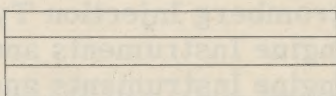
Recognition is given the Allison Division, General Motors Corporation, for co-operation and preparation of these charts.

Aircraft Piping

IDENTIFICATION TAPE

These colors conform to Army-Navy Certificate AN-9197-D for identifying aircraft piping.
NOTE: Widths of tapes as illustrated are not actual size. Single and two-color tapes are 1/2" wide, three-color tapes are 3/4" wide.

- SERVICE LIST -

	Fuel		Manifold Pressure
Red		White-Light Blue	
	Oil (Lubricating)		Vacuum
Yellow		White-Light Green	
	Coolant (Water)		Air Pressure (Com-pressed)
White		Light Blue-Light Green	
	Fire Extinguisher		Steam
Brown		Light Blue-Black	
	Flotation Equip-ment		Purging
Light Blue		Light Blue-Yellow	
	Oxygen		Exhaust Analyzer
Light Green		Light Blue-Brown	
	Airspeed: Pitot Pressure		Fluid, Ice Preven-tative
Black		White-Red	
	Airspeed: Static Pressure		Vent (Closed Com-partments)
Light Green-Black		Red-Black	
	Coolant (Prestone)		Hydraulic Pressure Oil
White-Black-White		Light Blue-Yellow-Light Blue	

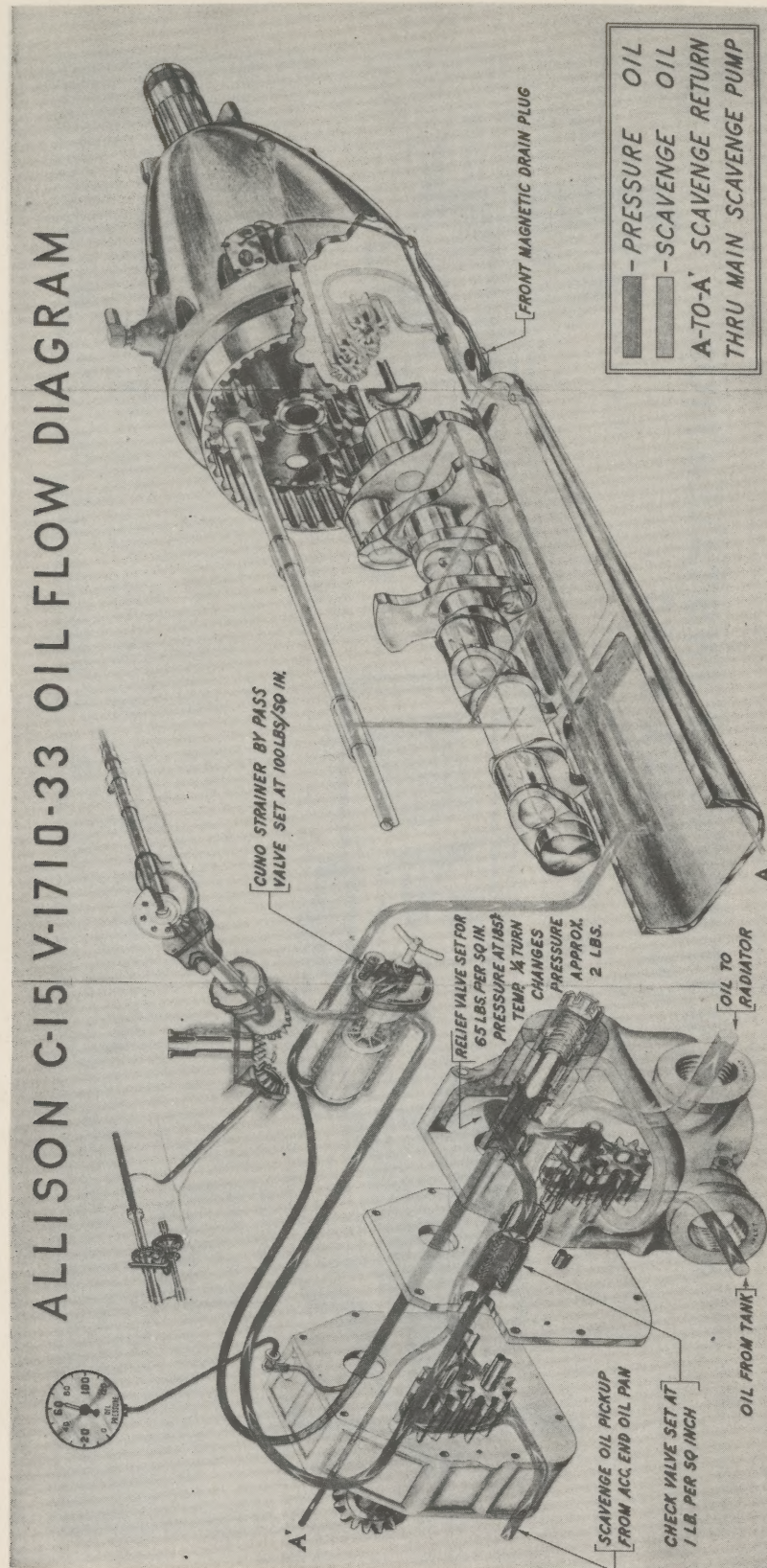
NOTE: Colors on charts in this book do not always conform to the Army Air Forces' color key as used in actual installations.

INDEX OF CHARTS AND DIAGRAMS

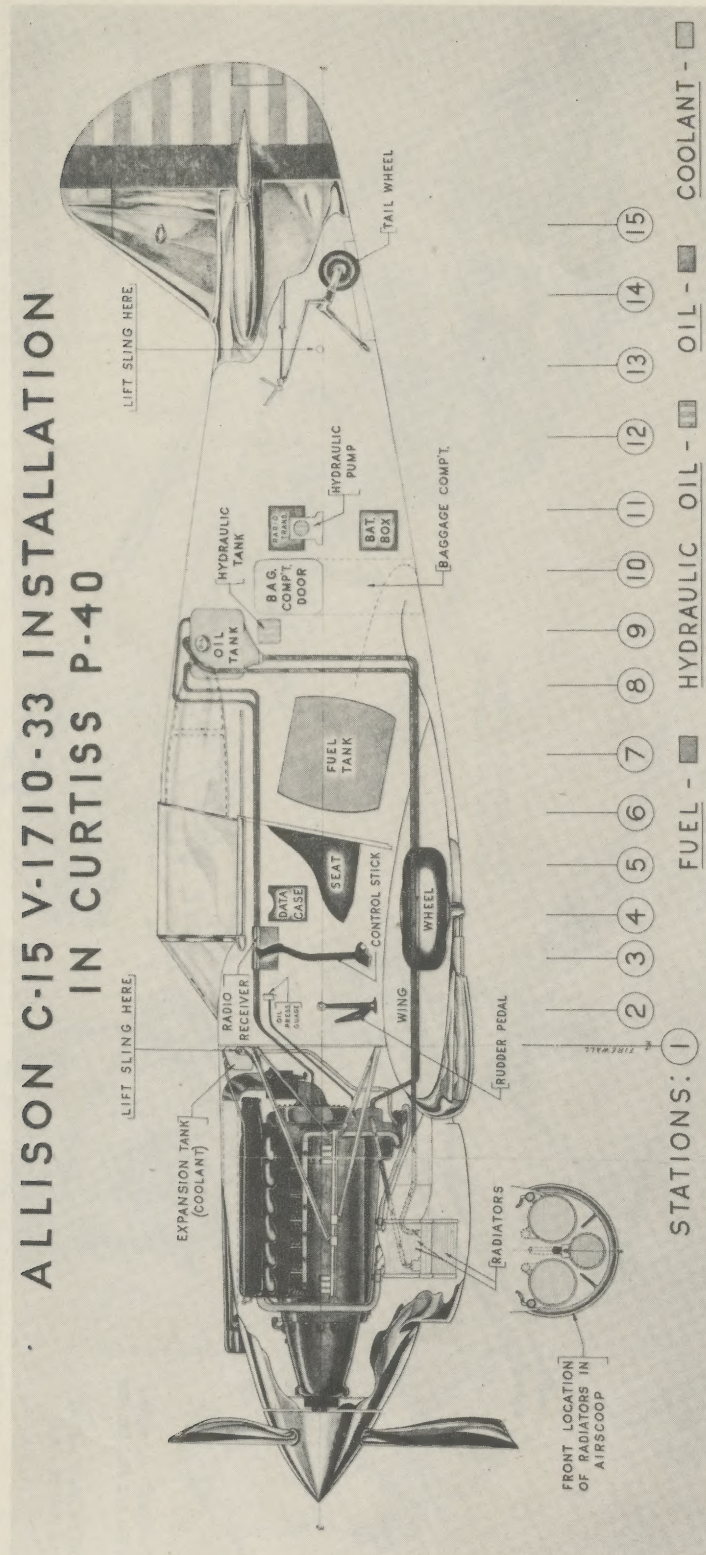
ALLISON ENGINES

1. C-15 Engine Lubrication System
2. C-15 Engine Installation in P-40 Curtiss
3. C-15 Coolant System in P-40 Curtiss
4. C-15 Lubrication System in P-40 Curtiss
5. C-15 Fuel System in P-40 Curtiss
6. C-15 Electrical System in P-40 Curtiss
7. F Type Engine Lubrication System
8. F 3R Engine Installation P-40D Curtiss
9. Curtiss P-40D Coolant System
10. Curtiss P-40D Lubrication System
11. Curtiss P-40D Fuel System Engine Comp.
12. Curtiss P-40D Fuel System Tank
13. Curtiss P-40D Electrical System
14. F-2 Engine Installation P-38 Lockheed
15. Lockheed P-38 Coolant System
16. Lockheed P-38 Lubrication System
17. E-4 Installation in P-39 Bell
18. Bell P-39 Coolant System
19. Bell P-39 Lubrication System
20. Bell P-39 Fuel System
21. F-3R Installation North American P-51
22. Fuel Air Flow
23. Flame Chart
24. Vibration Damper
25. Reduction Gear Oil Diagram
26. Relationship of Oil Strainer and Pressure Relief Valve
27. F-2L Timing Chart
28. F R&E Timing Chart
29. C-15 Timing Chart
30. Fuel Characteristics at Altitude
31. Stromberg Injection Type Carburetor
32. Engine Instruments and Controls P-40 D and E
33. Engine Instruments and Controls P-39 F
34. Engine Instruments and Controls P-38 E
35. Turbo Supercharger
36. Engine Accessories and Locations
37. Manifold Pressure Regulator
38. Piston Ring Placement Diagram
39. Engine Cross-Section

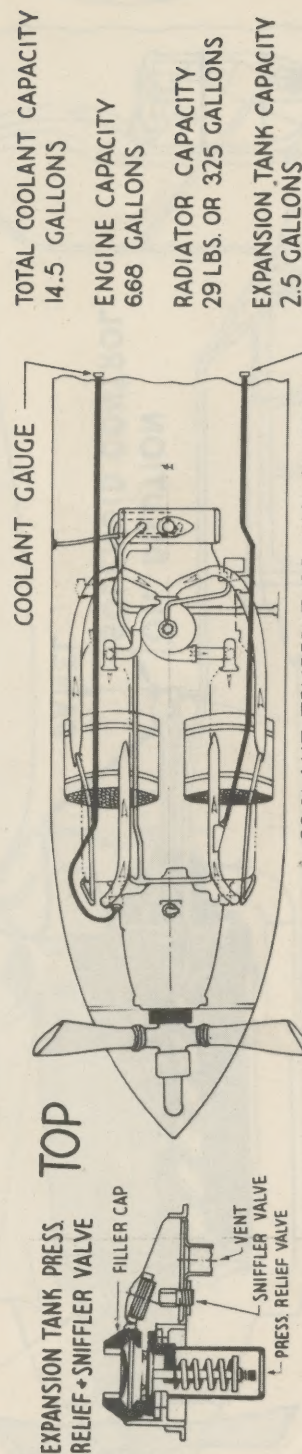
ALLISON C-15 V-1710-33 OIL FLOW DIAGRAM



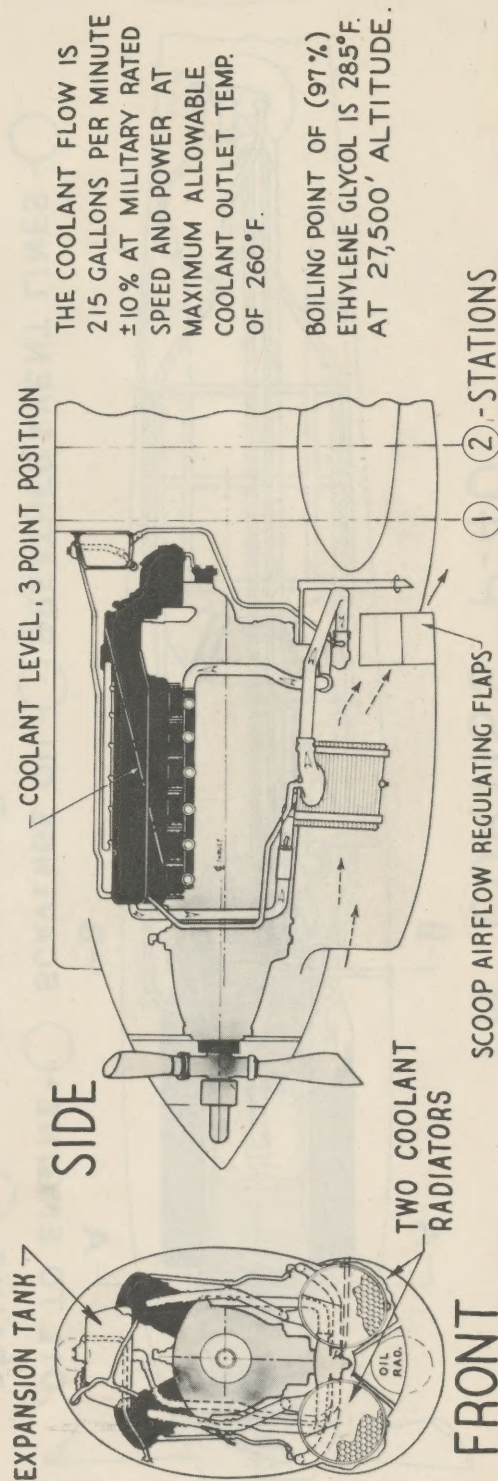
ALLISON C-15 V-1710-33 INSTALLATION IN CURTISS P-40



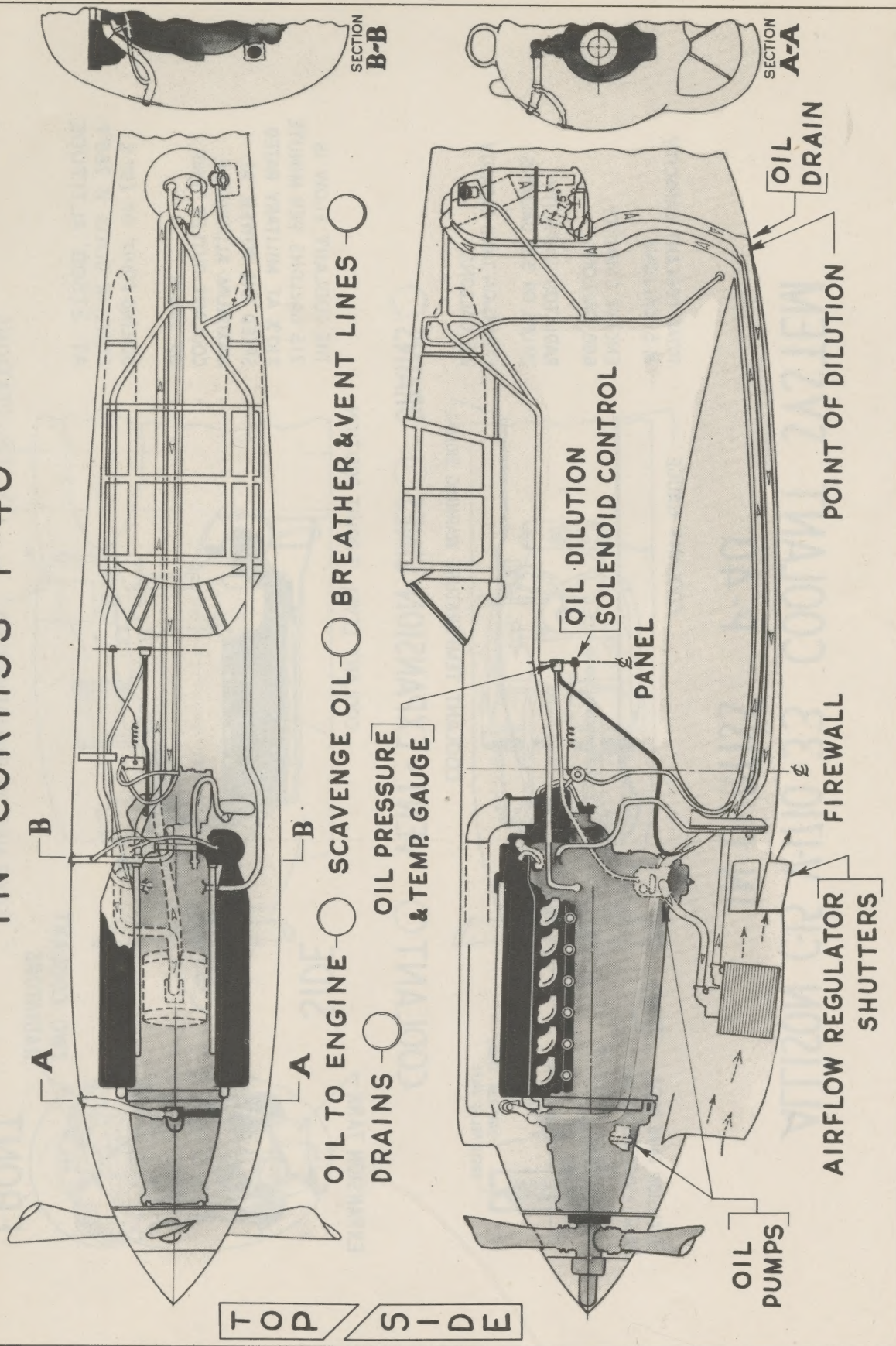
ALLISON C-15 V-1710-33 COOLANT SYSTEM IN CURTISS P-40



COOLANT ○ VENT + EXPANSION LINES ○ DRAINS ○



ALLISON C-15 V-1710-33 LUBRICATION SYSTEM IN CURTISS P-40

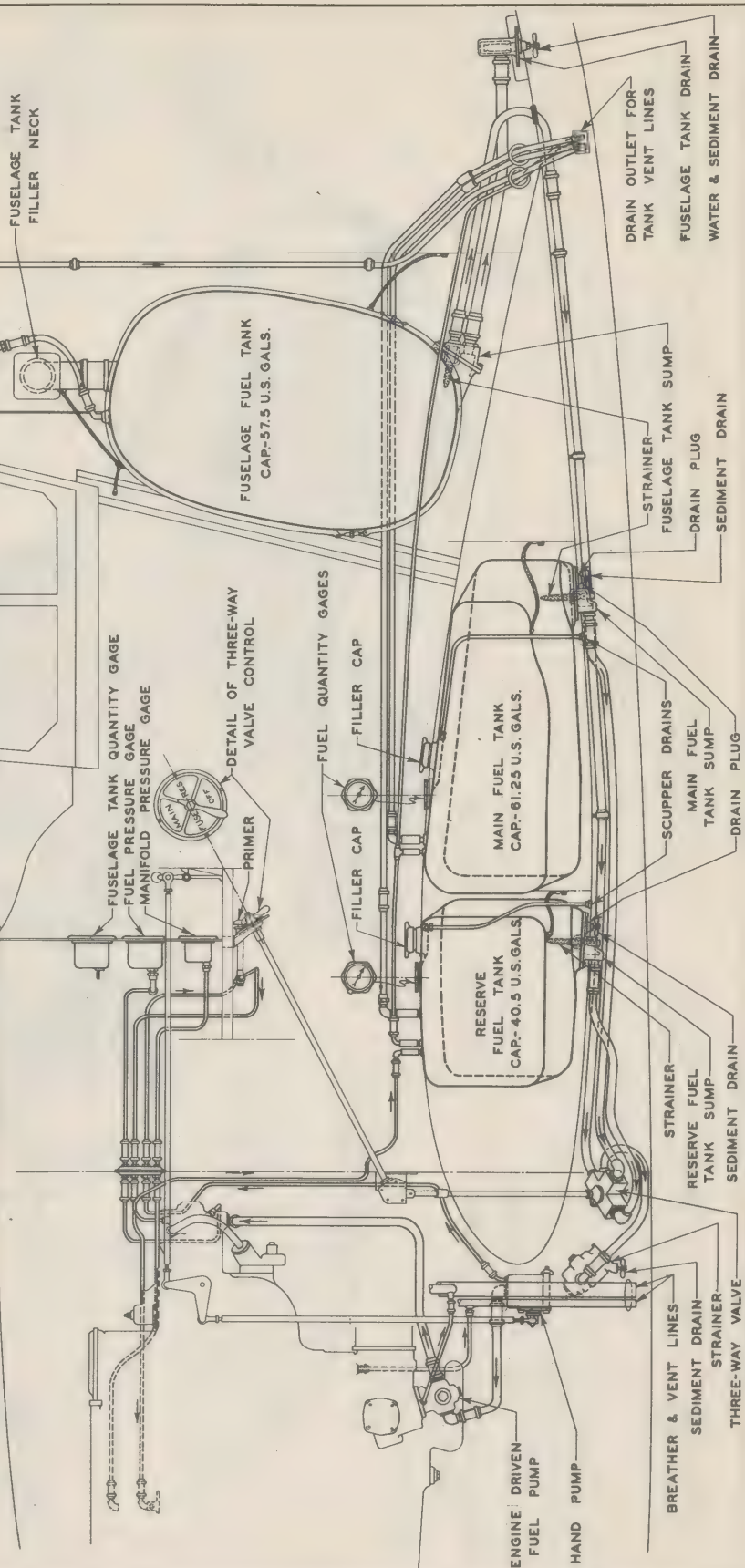


C-15 V-1710-33 FUEL SYSTEM IN CURTISS P-40

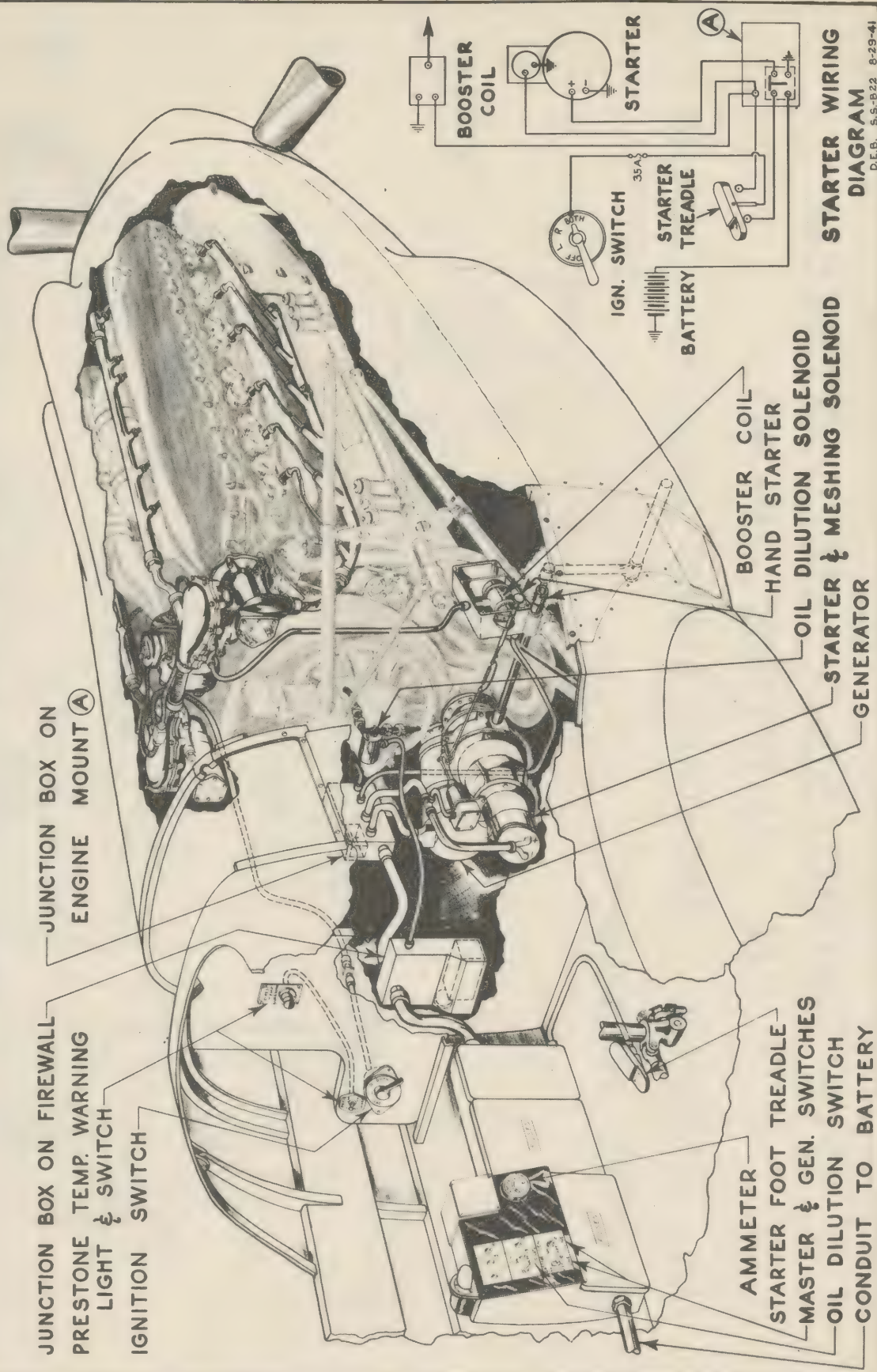
FUEL LINES—○ BREATHER & VENT LINES—○ DRAINS—○

MANIFOLD PRESSURE—○

EXPANSION TANK
CAP-1.75 U.S. GALS.



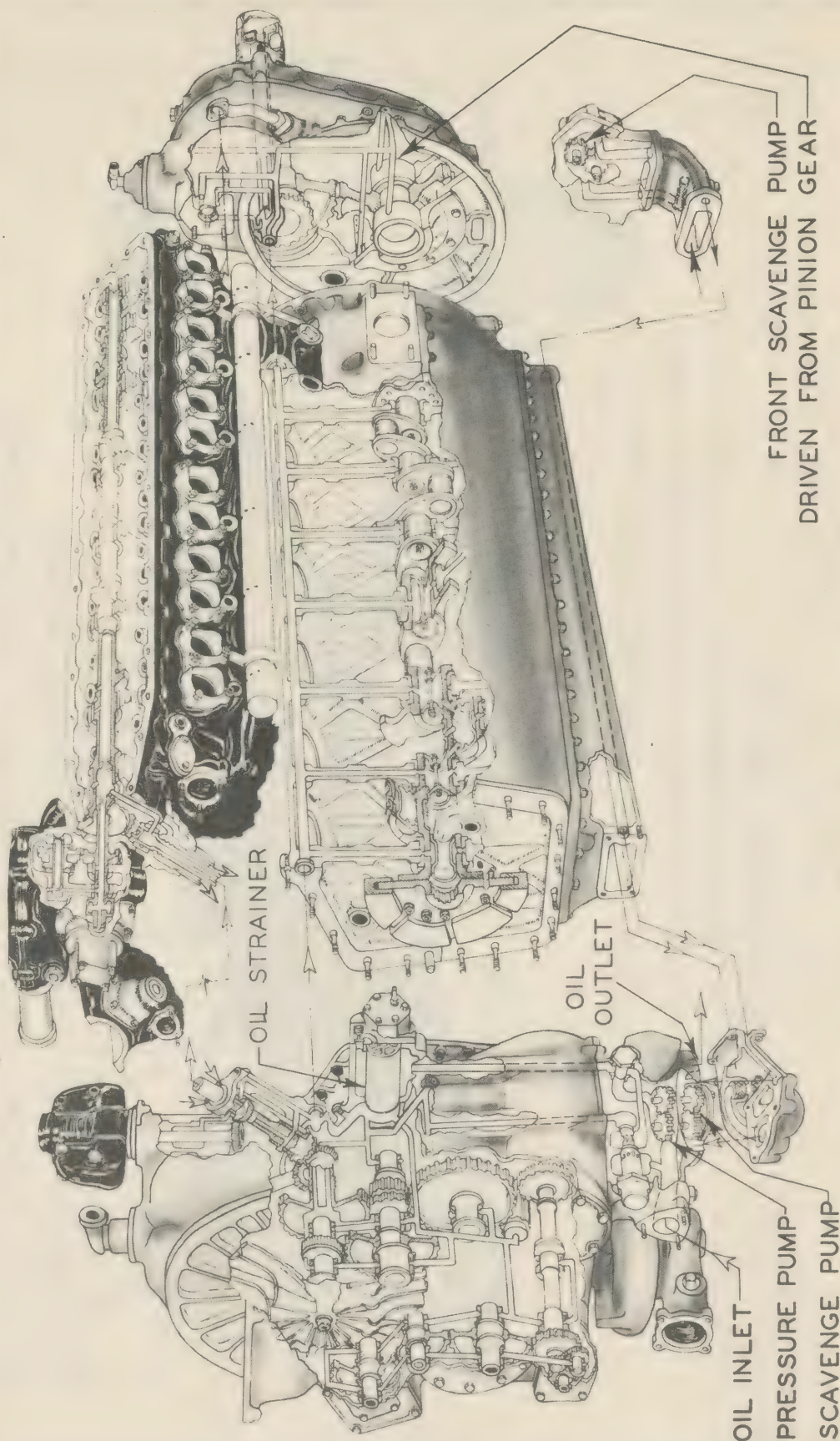
C-15 V-1710-33 IGNITION & ELECTRICAL SYSTEM IN CURTISS P-40C



ALLISON "F" TYPE ENGINE LUBRICATION SYSTEM

V-1710-27, 29, 39, 49 & 53 ENGINES

E-4, V-1710-35 TYPE ENGINE APPLIES WITH EXCEPTION OF REDUCTION GEAR

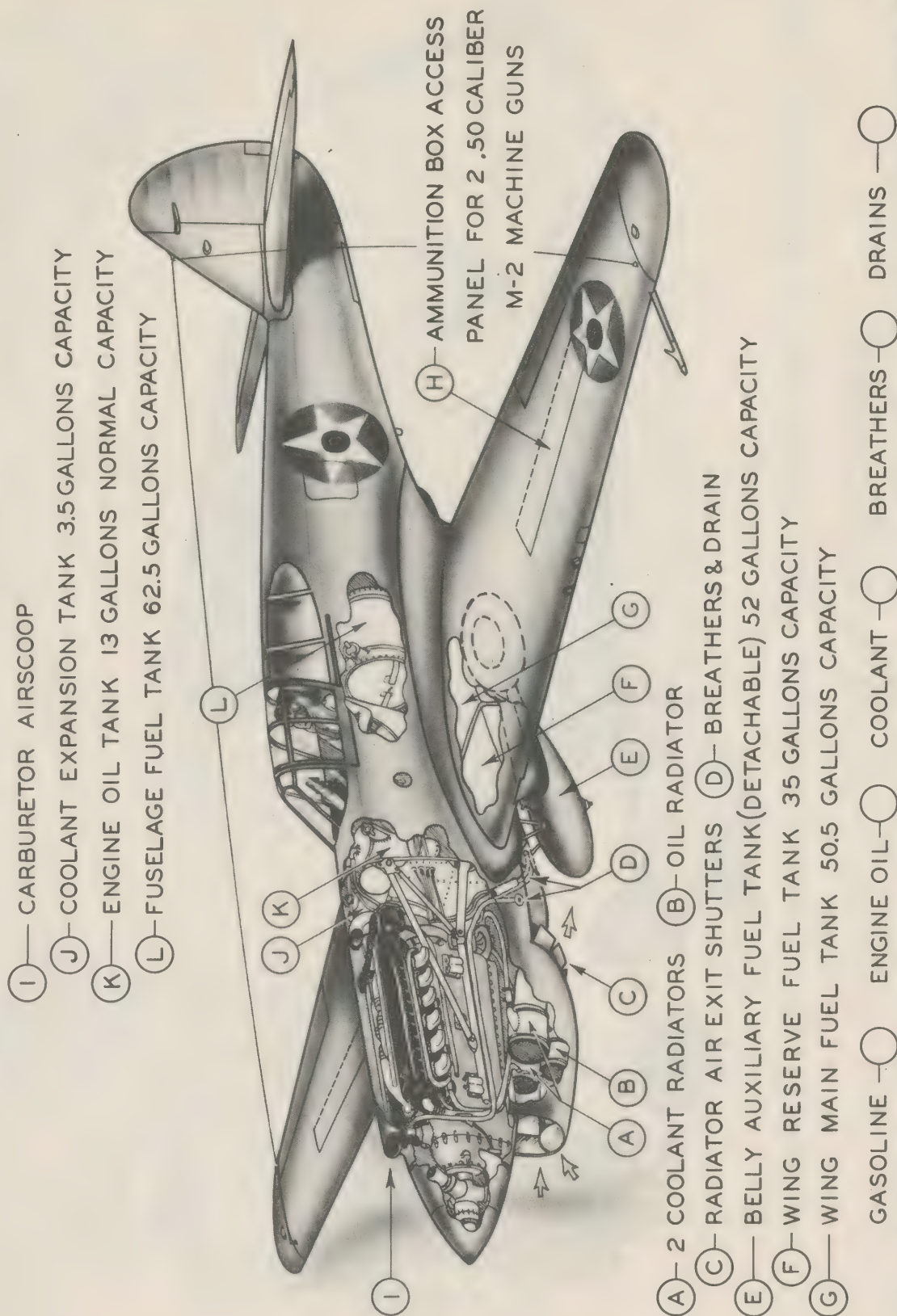


PRESSURE OIL—○

SCAVENGE OIL—○

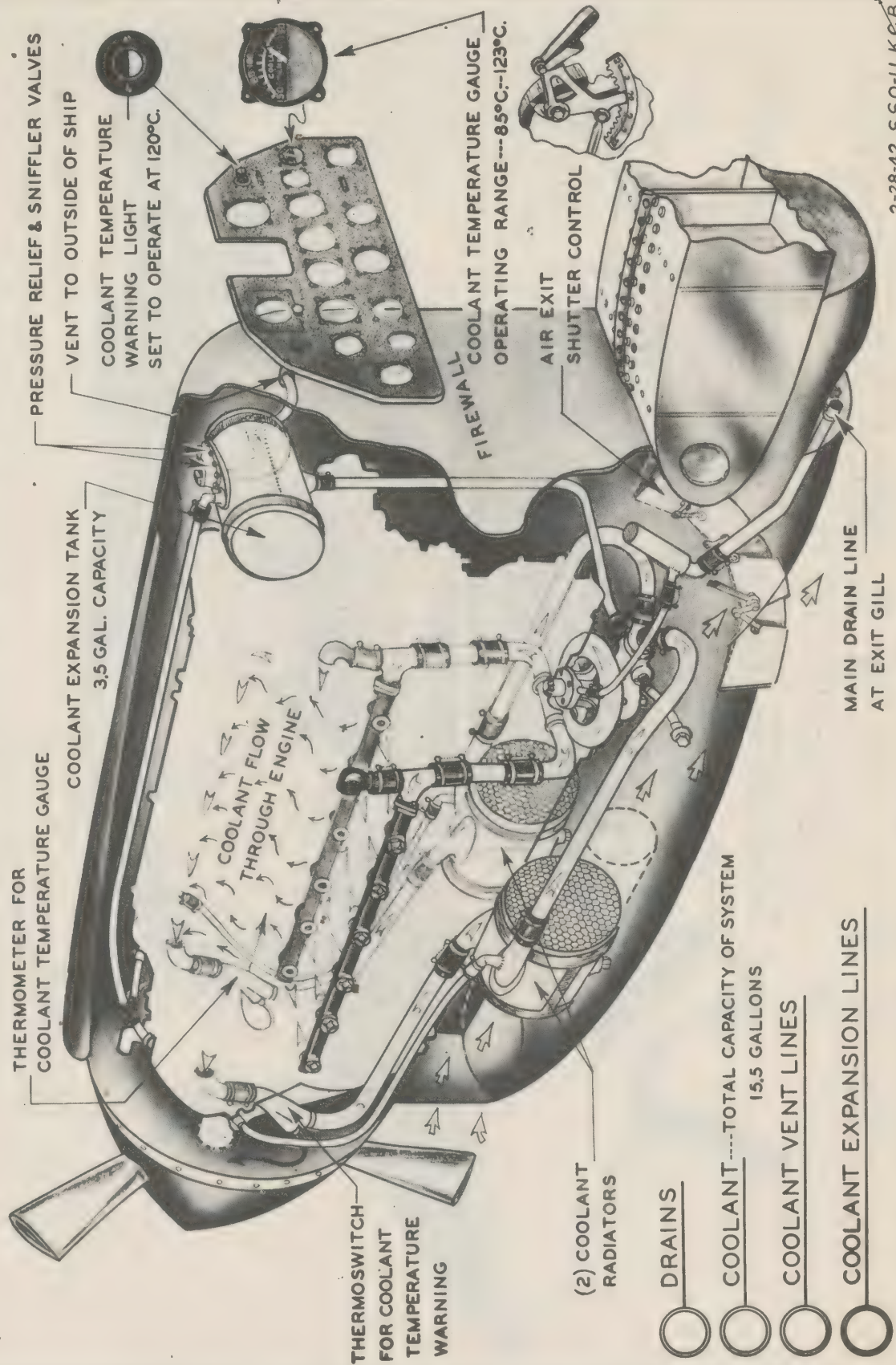
GOVERNOR PRESSURE OIL—○

ALLISON F-3R V-1710-39 INSTALLATION IN CURTISS P-40-D

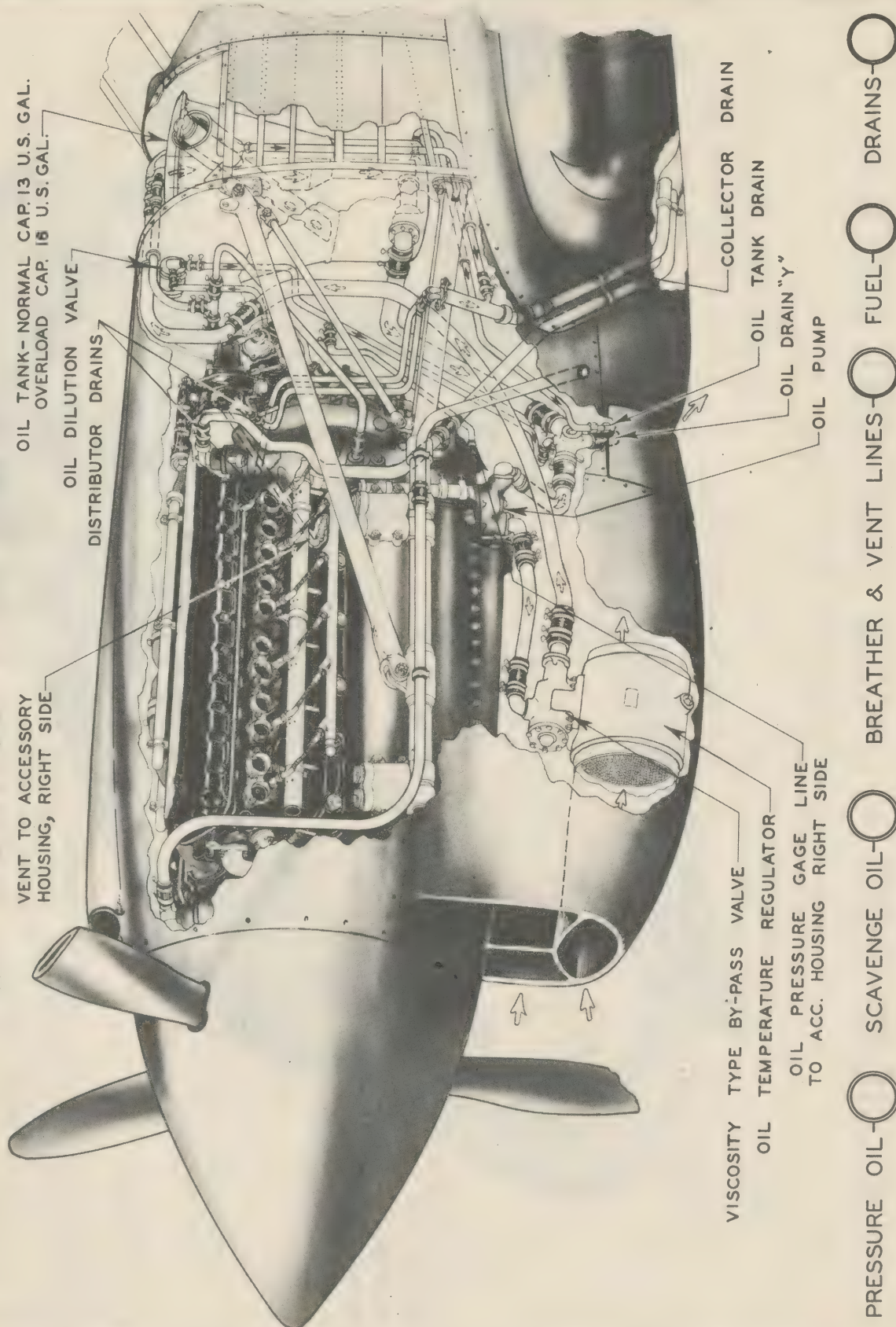


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ALLISON F-3R V-1710-39 COOLANT SYSTEM IN CURTISS P-40D & E



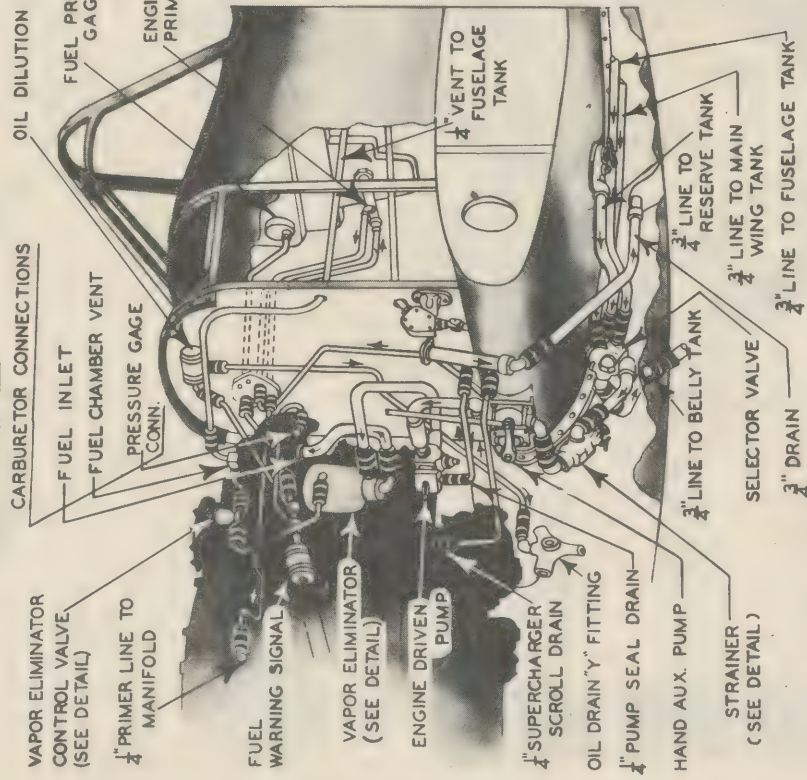
ALLISON F-3R V-1710-39 LUBRICATION SYSTEM IN CURTISS P-40 D & E



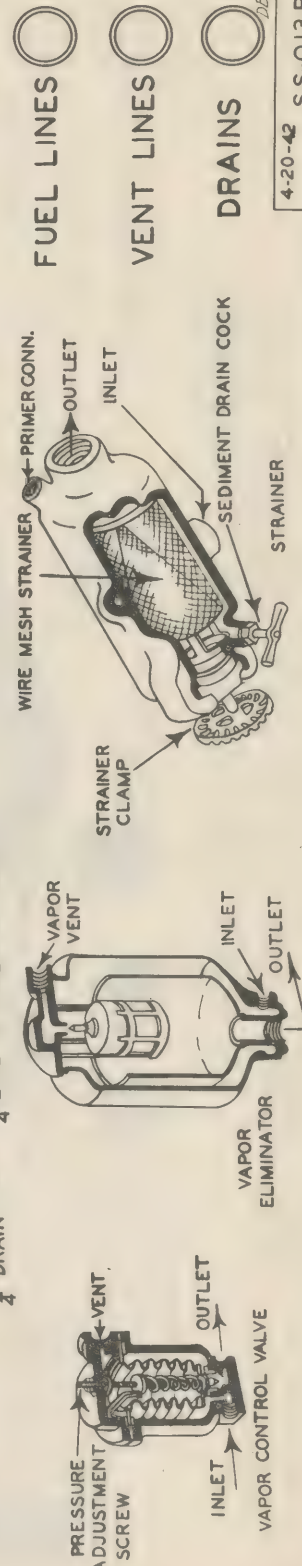
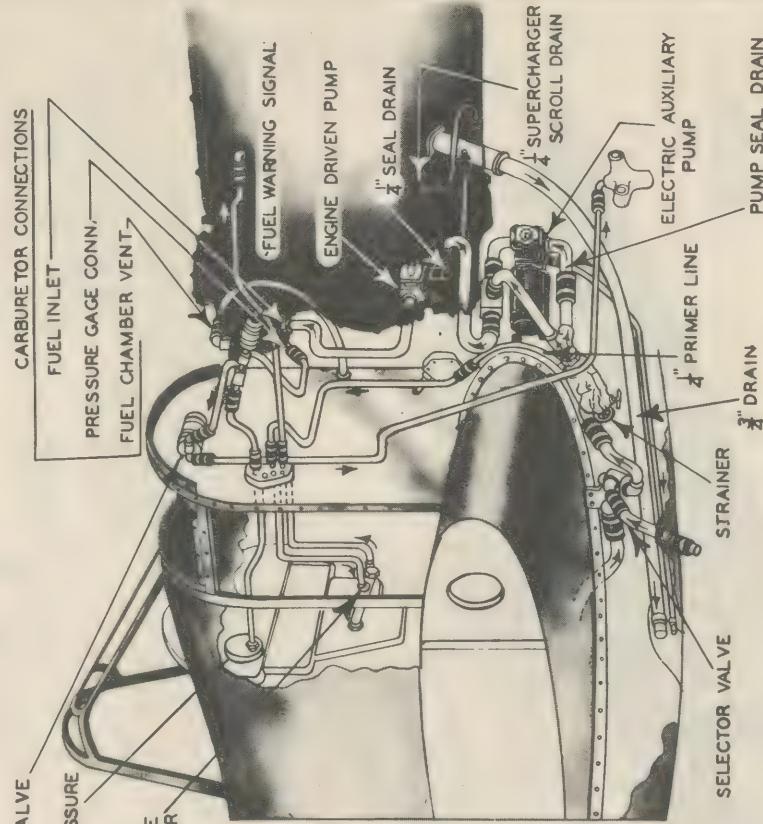
D.E.B. 1-10-42 S.S.-010

ALLISON F-3R V-1710-39 INSTALLATION IN CURTISS P-40D & E (ENGINE COMPARTMENT)

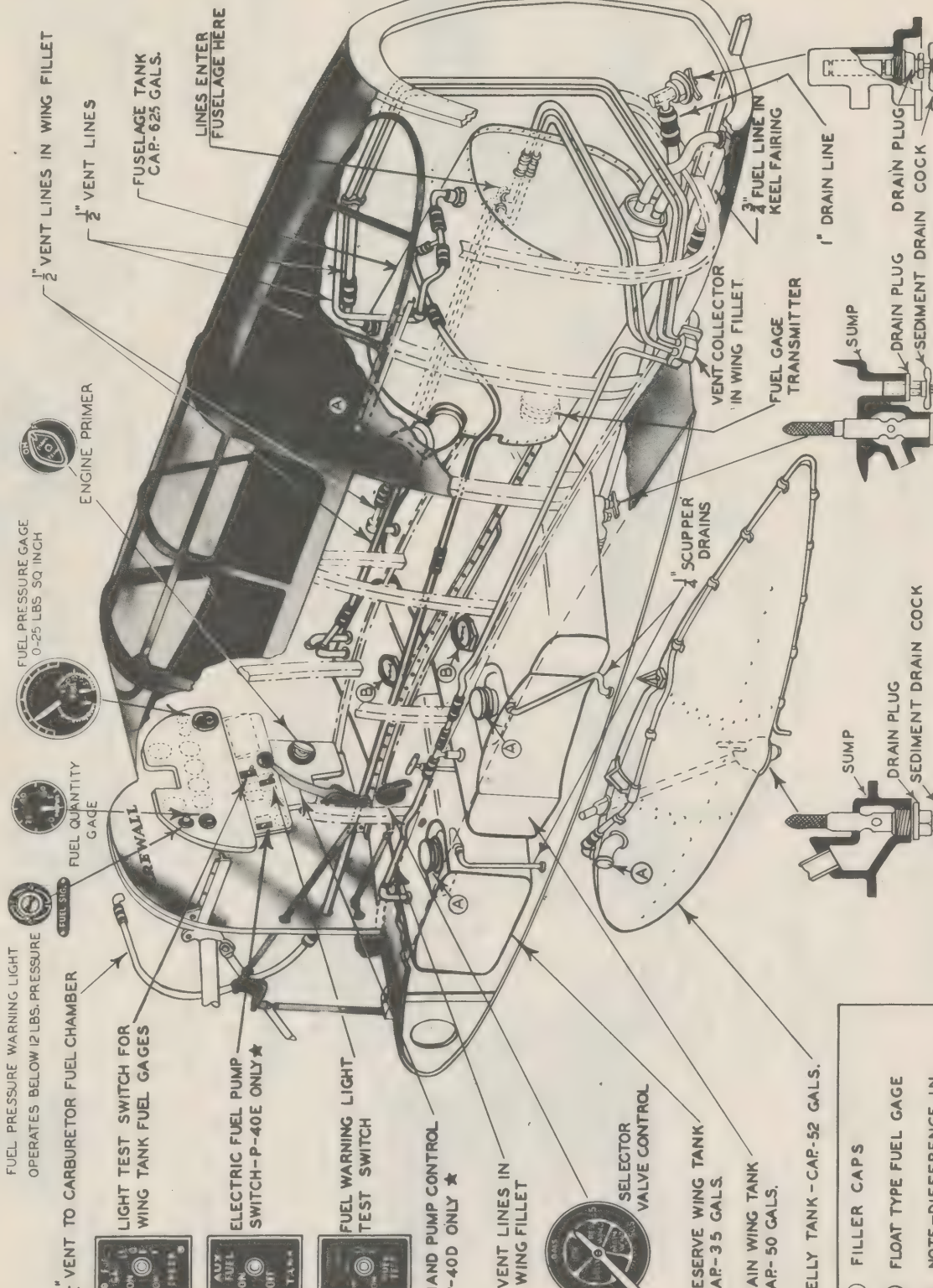
INSTALLATION WITH VAPOR ELIMINATOR AND HAND AUX. PUMP



INSTALLATION WITH ELECTRIC AUX. PUMP

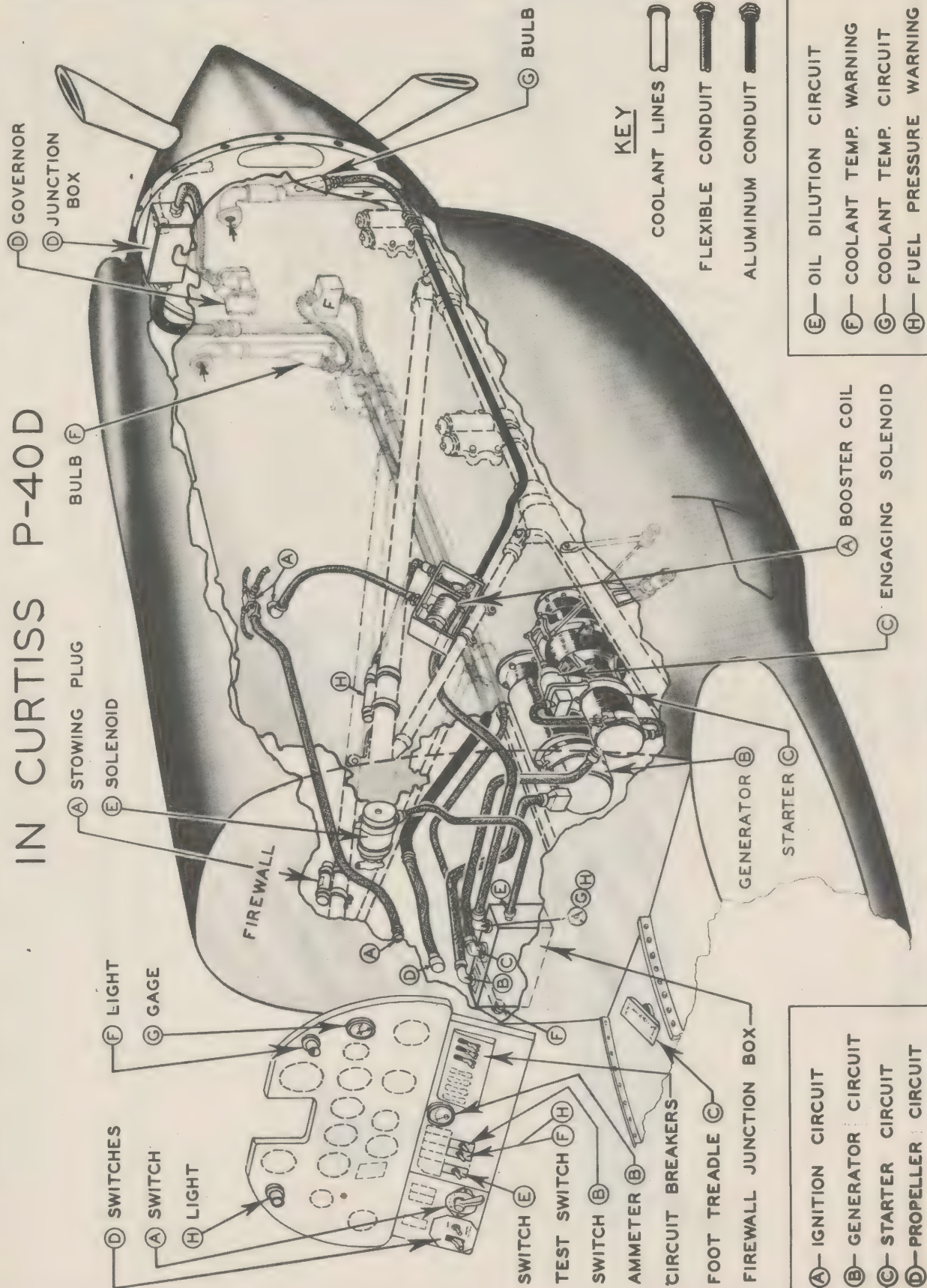


IN CURTISS P-40D & E (TANKS GAGES AND CONTROLS)



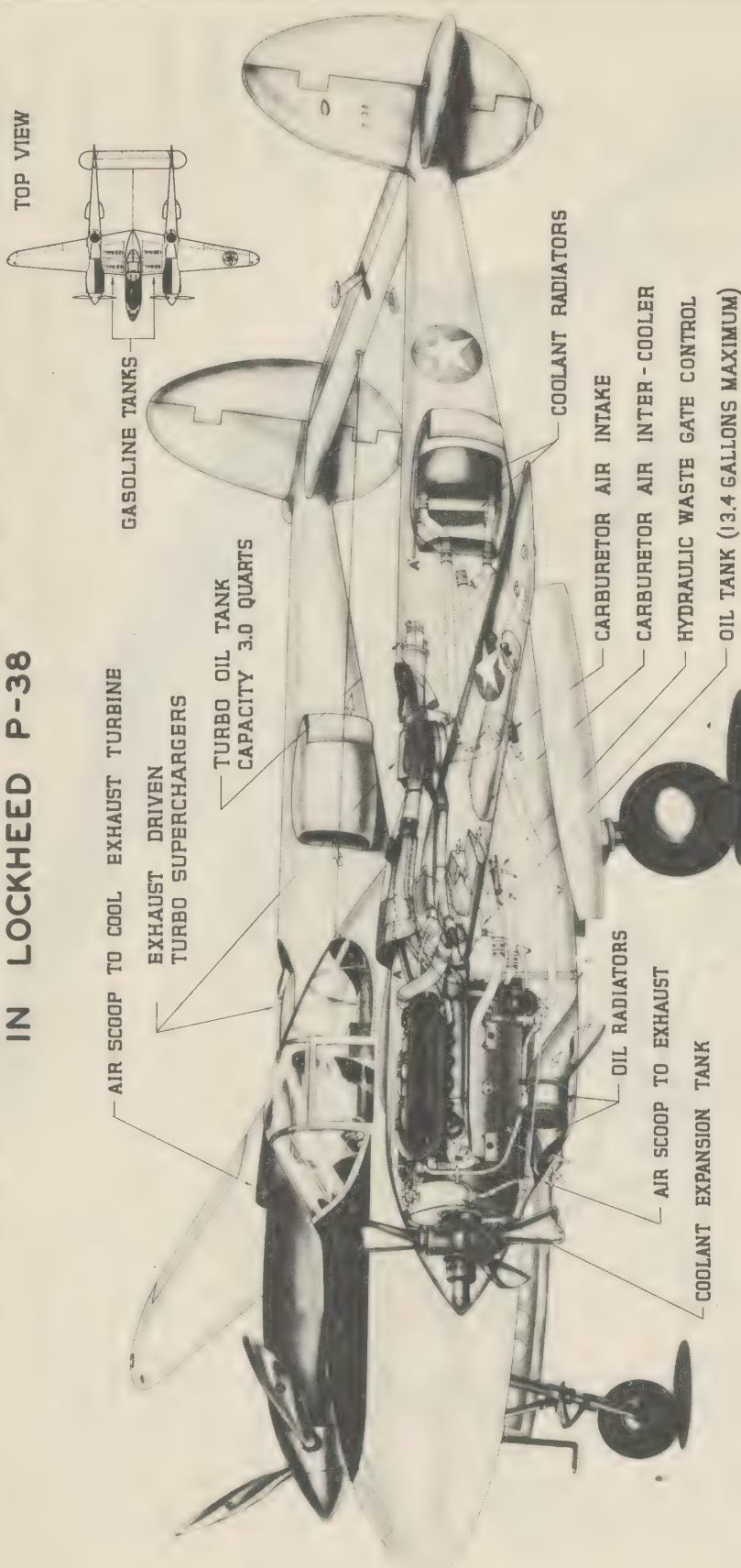
D AND E INSTALLATION

ALLISON F-3R V-1710-39 ELECTRICAL SYSTEM IN CURTISS P-40D



ALLISON F-2R & L V-1710-27 & 29 INSTALLATION IN LOCKHEED P-38

TOP VIEW



COLOR KEY

- GASOLINE — ○ —
- PRESTONE — ○ —
- BREATHING & VENT LINES — ○ —
- ENGINE AND TURBO OIL - (PRESSURE) — ○ — (SCAVENGE) — ○ —
- COMPRESSED AIR FROM TURBO — ○ —
- DRAINS — ○ —
- FREE AIR FLOW — ○ —
- EXHAUST GAS — ○ —

ALLISON F-5R&L V-1710-49&53 COOLANT SYSTEM IN LOCKHEED P-38F

LEFT ENGINE INSTALLATION SHOWN—RIGHT ENGINE INSTALLATION FUNDAMENTALLY THE SAME

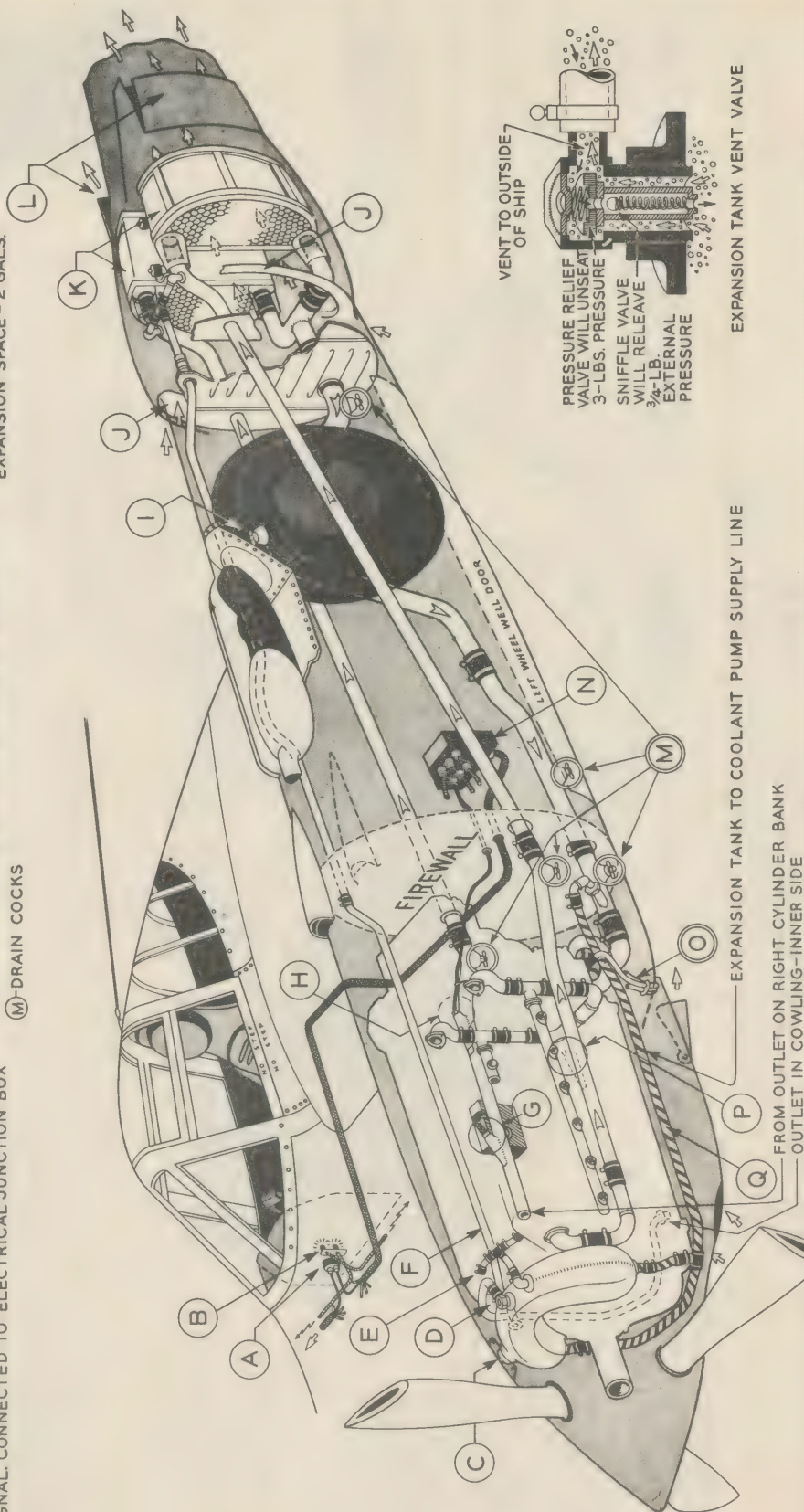
- (A) AUTOSYN CONTROLLED TEMPERATURE GAUGE
- (B) COOLANT TEMPERATURE WARNING SIGNALS (LIGHTS)
- (C) EXPANSION TANK FILLER CAP & ACCESS DOOR
- (D) VENT VALVE TO OUTSIDE SHIP (SEE DETAIL)
- (E) VENTS FROM CYLINDER HEADS TO EXPANSION TANK
- (F) VENT LINE FROM RADIATORS TO EXPANSION TANK
- (G) THERMOMETER WELL FOR TEMPERATURE WARNING SIGNAL, CONNECTED TO ELECTRICAL JUNCTION BOX

- (H) THERMOMETER WELL FOR TEMPERATURE GAUGE CONNECTED TO AUTOSYN JUNCTION BOX
- (I) AIRBLEED COCK
- (J) AIRSCOOP FOR RADIATORS
- (K) 2 RADIATORS (CARTRIDGE CORE TYPE) ATTACHED TO BOOM STRUCTURE BY 4 (EACH) LORD BUSHINGS
- (L) RADIATOR AIR EXIT SHUTTERS HYDRAULICALLY OPERATED FROM CONTROL HANDLE IN COCKPIT
- (M) DRAIN COCKS

- (N) AUTOSYN INSTRUMENT JUNCTION BOX
- (O) COOLANT PUMP SEAL DRAIN
- (P) LOCATION OF THERMOMETER WELL FOR TEMPERATURE GAUGE ON RIGHT ENGINE INSTALLATION ONLY
- (Q) COOLANT EXPANSION LINE

—CAPACITIES—

COOLANT CAPACITY ENTIRE SYSTEM, APPROX. 25 GALS.
COOLANT CAPACITY OF TANK 1.8 GALS.
EXPANSION SPACE—2 GALS.



- COOLANT
- EXPANSION—SUPPLY LINE
- VENT LINES
- FREE AIR FLOW
- DRAINS

ALLISON F-2R & L V-1710-27 & 29 OIL SYSTEM IN LOCKHEED P-38 E

NOTE - LEFT HAND ENGINE (F-2L) INSTALLATION IS SHOWN
RIGHT HAND ENGINE (F-2R) INSTALLATION IS FUNDAMENTALLY THE SAME

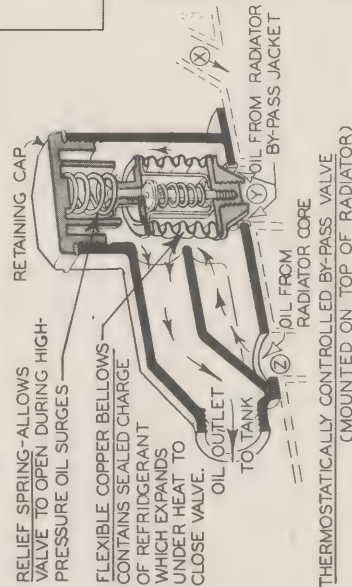
KEY TO CONNECTIONS ON ENGINE

- (A) - RIGHT DISTRIBUTOR DRAIN
- (B) - REAR ENGINE BREATHER
- (C) - LEFT DISTRIBUTOR DRAIN
- (D) - FUEL PRESSURE TAP ON CARBURETOR
- (E) - VENT TO ENGINE - RIGHT SIDE
- (F) - PRESSURE OIL TAP FOR TURBO REG.
- (G) - VENT TO ENGINE - LEFT SIDE
- (H) - PRESSURE OIL TAP - RIGHT REAR OF ENGINE (FOR PRESSURE GAGE)
- (I) - DRAIN TAP TO ENGINE LEFT SIDE (FOR TURBO REG.)
- (J) - OUTLET FROM PUMP
- (K) - INLET TO PUMP
- (L) - OIL TEMP BULB - CAPILLARY TUBE CONNECTION
- (M) - FRONT ENGINE BREATHER

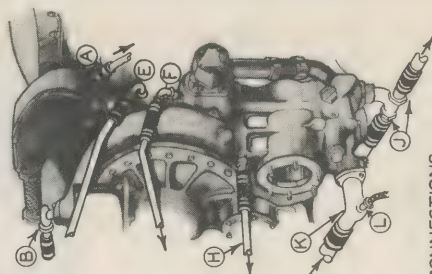


RADIATOR BY-PASS VALVES

OIL RADIATORS



BY-PASS VALVE OPERATION
OIL ENTERS RADIATOR CORE OR JACKET AT (X). IF OIL IS HOT VALVE CLOSURES PASSAGE (Y), FORCING OIL THRU RADIATOR AND OUT AT PASSAGE (Z). IF OIL IS COOL VALVE OPENS, ALLOWING OIL TO TAKE THE PATH OF LEAST RESISTANCE, PASSING OUT AT (Y). VALVE BEGINS TO OPEN AT OIL TEMPERATURES OF 37° TO 41° C. VALVE IS FULLY CLOSED AT OIL TEMP OF 62° TO 67° C.



CONNECTIONS ON ACCESSORIES HOUSING RIGHT SIDE

5-20-42 SS-O14

DRAINS

FUEL

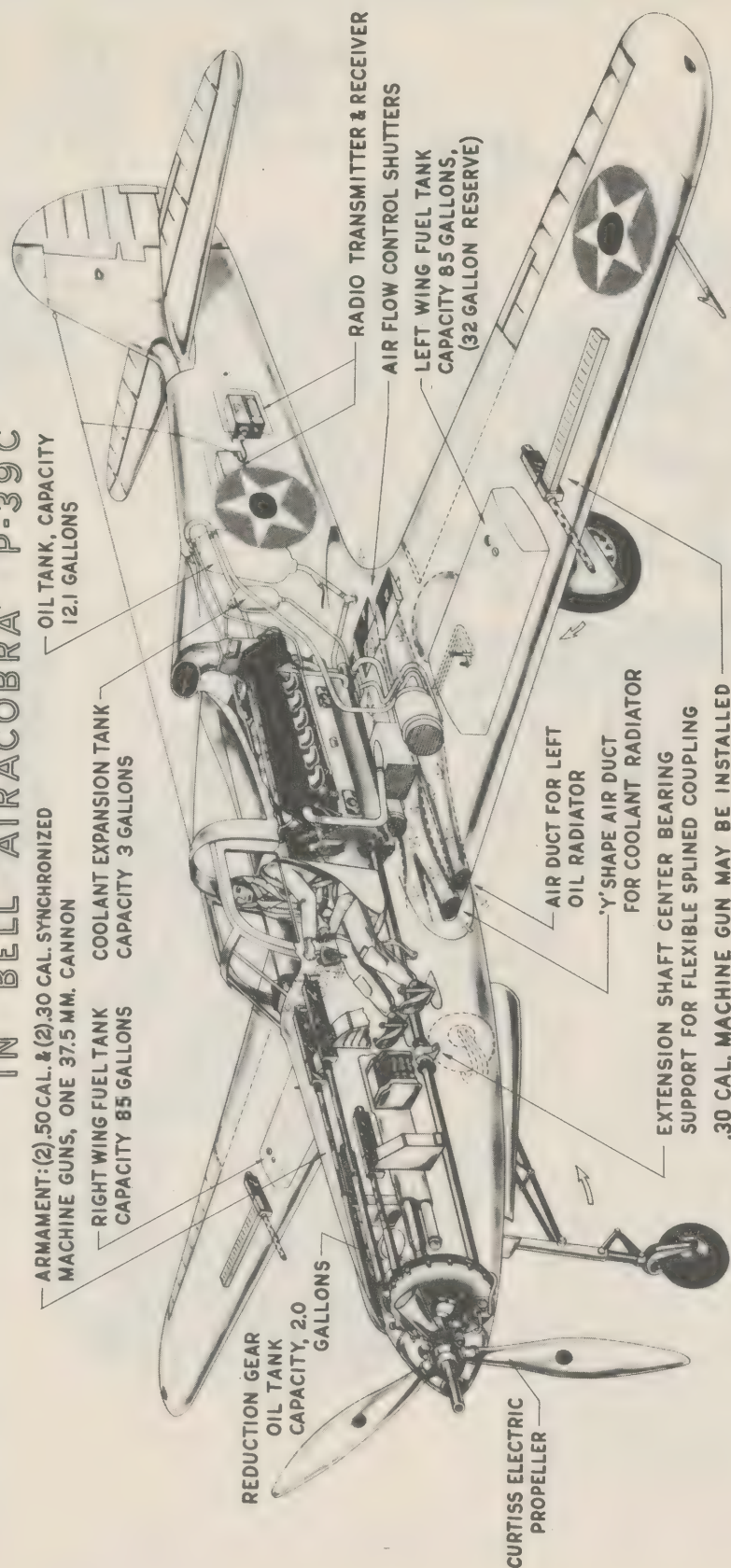
FREE AIR FLOW

BREATHERS AND VENTS

SCAVENGE OIL

PRESSURE OIL

ALLISON E-4 V-1710-35 INSTALLATION IN BELL 'AIRACOBRA' P-39C

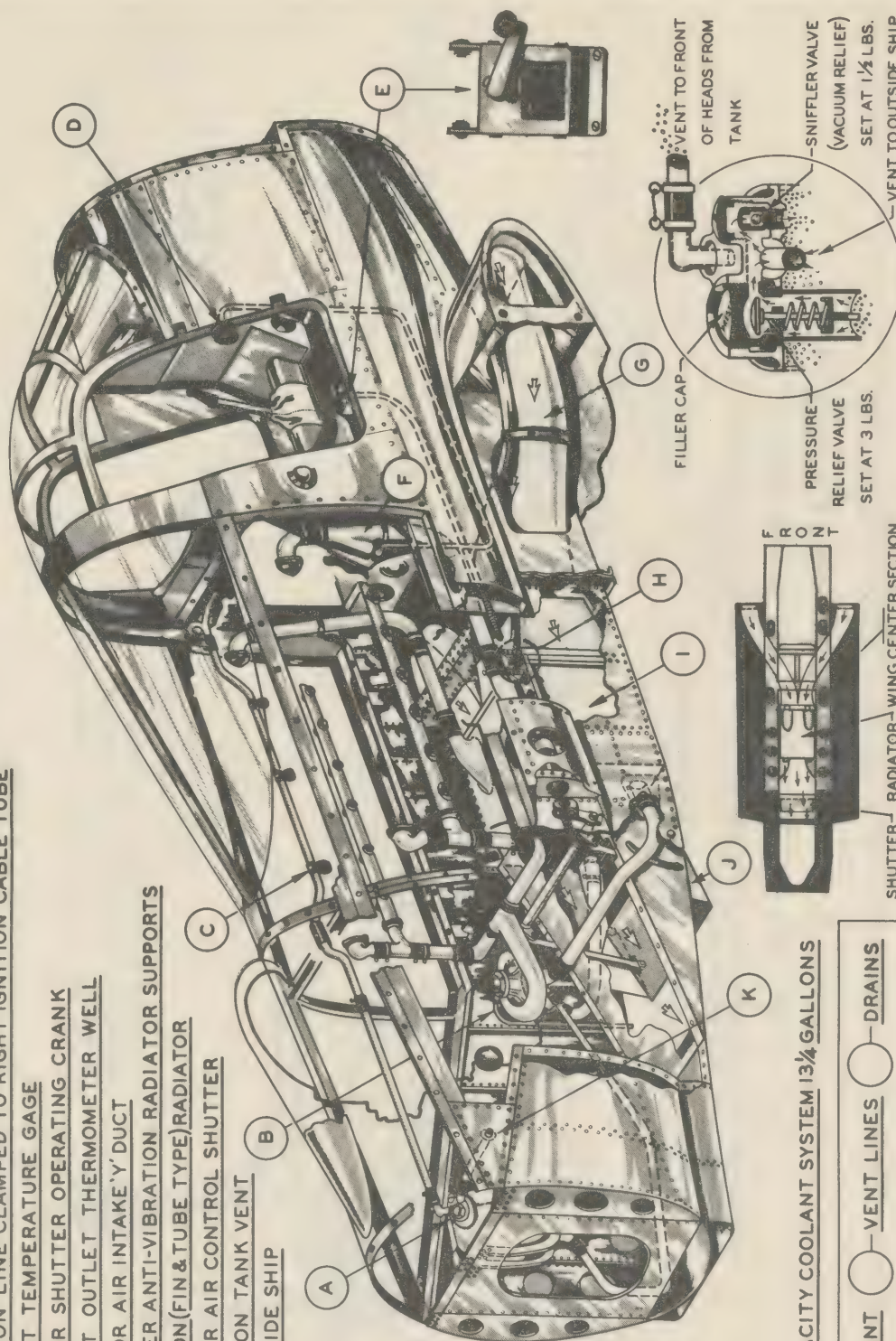


COLOR KEY

GASOLINE — COOLANT — ENGINE & REDUCTION GEAR OIL (PRESSURE) — (SCAVENGE) —
BREATHING & VENT LINES — FREE AIR FLOW —

ALLISON E-4 V-1710-35 COOLANT SYSTEM IN BELL AIRACOBRA P-39D

- A. COOLANT EXPANSION TANK. 3 U.S. GALLONS, CAPACITY
- B. COOLANT PUMP SEAL DRAIN
- C. EXPANSION LINE CLAMPED TO RIGHT IGNITION CABLE TUBE
- D. COOLANT TEMPERATURE GAGE
- E. RADIATOR SHUTTER OPERATING CRANK
- F. COOLANT OUTLET THERMOMETER WELL
- G. RADIATOR AIR INTAKE 'Y' DUCT
- H. (4) RUBBER ANTI-VIBRATION RADIATOR SUPPORTS
- I. HARRISON (FIN & TUBE TYPE) RADIATOR
- J. RADIATOR AIR CONTROL SHUTTER
- K. EXPANSION TANK VENT TO OUTSIDE SHIP



TOTAL CAPACITY COOLANT SYSTEM 13 1/4 GALLONS

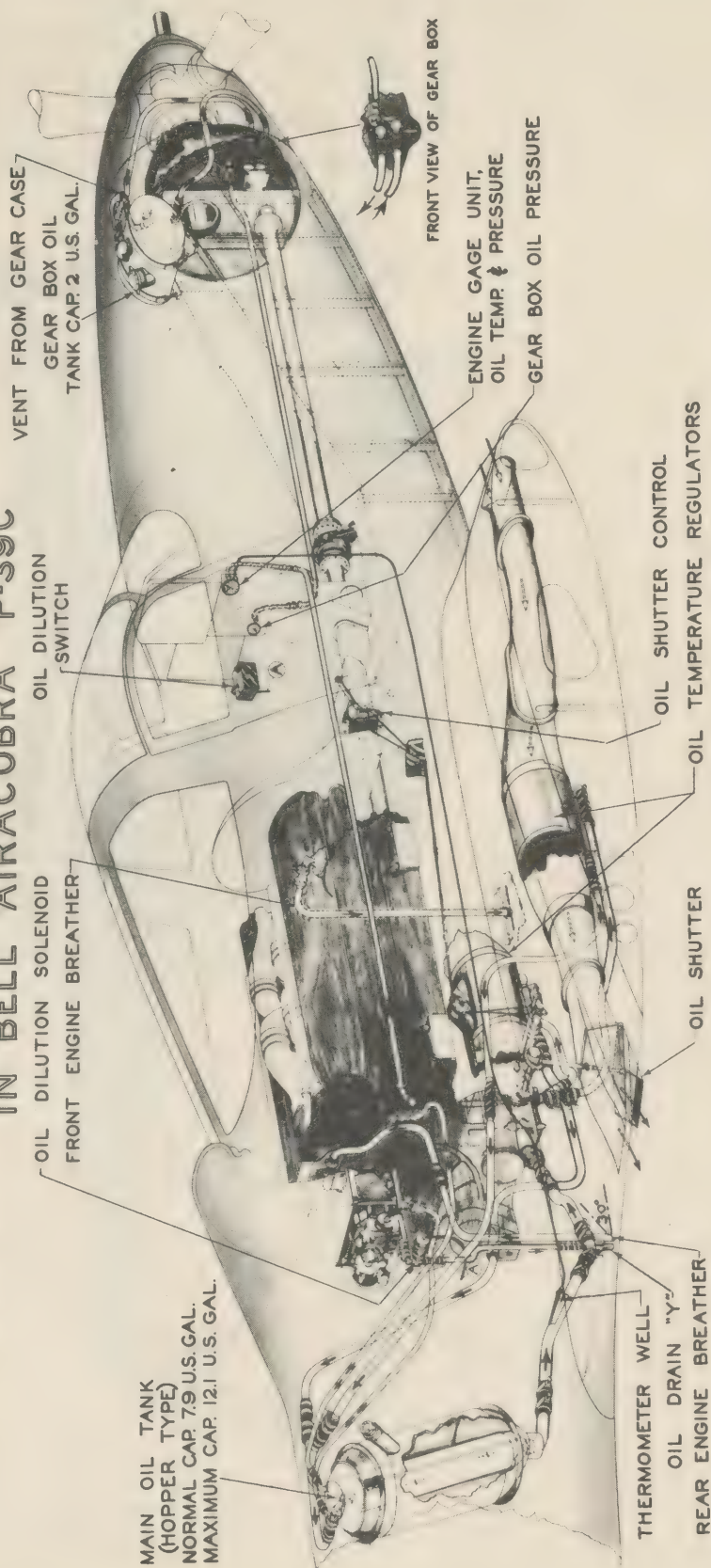
- COOLANT
- VENT LINES
- DRAINS
- EXPANSION LINES
- FREE AIR FLOW

EXPANSION TANK VALVE DETAIL

5-28-42 SSO-17 KCB

PLAN VIEW, RADIATOR AIR DUCTS

ALLISON E-4 V-1710-35 LUBRICATION SYSTEM IN BELL 'AIRACOBRA' P-39C

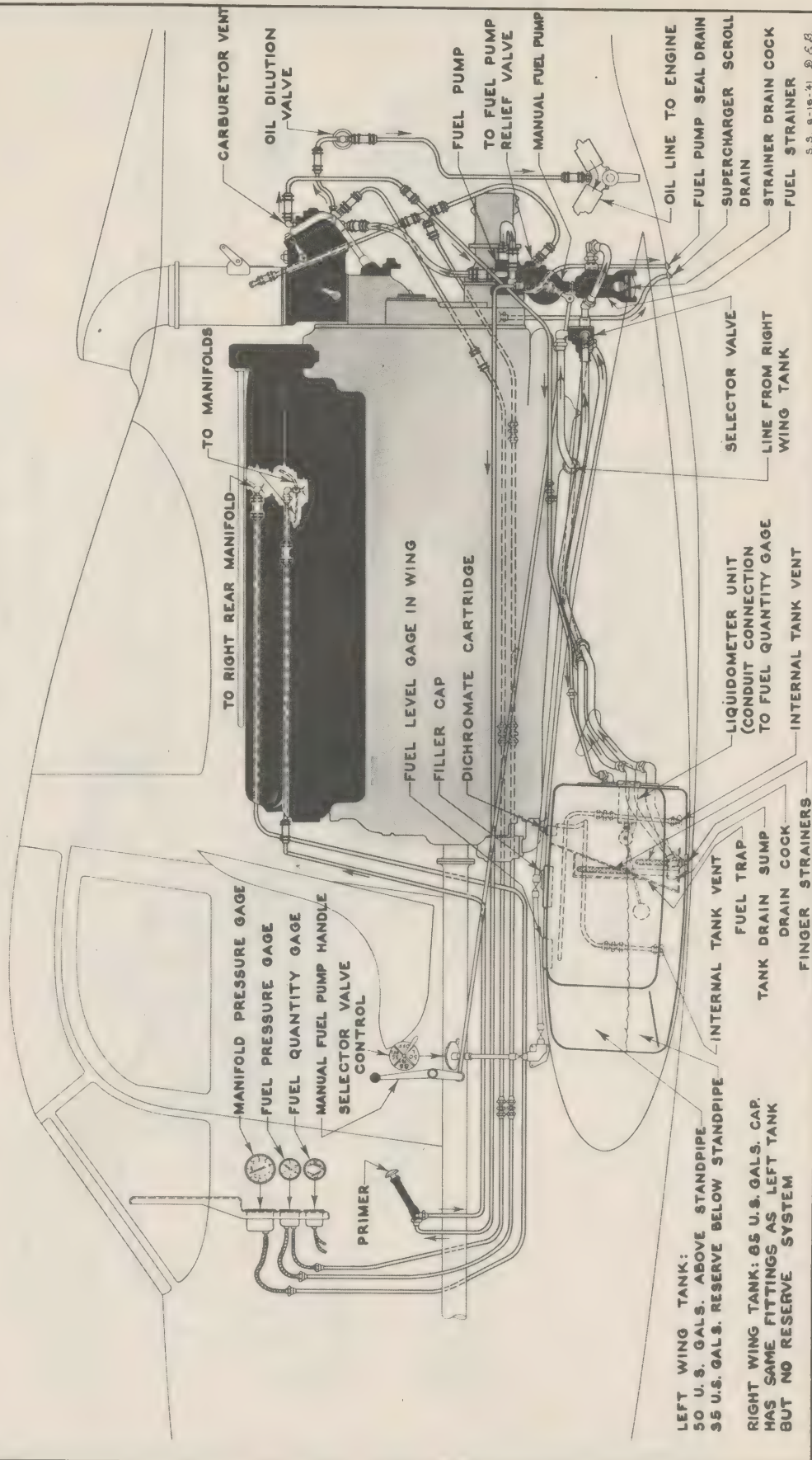


—COLOR KEY—

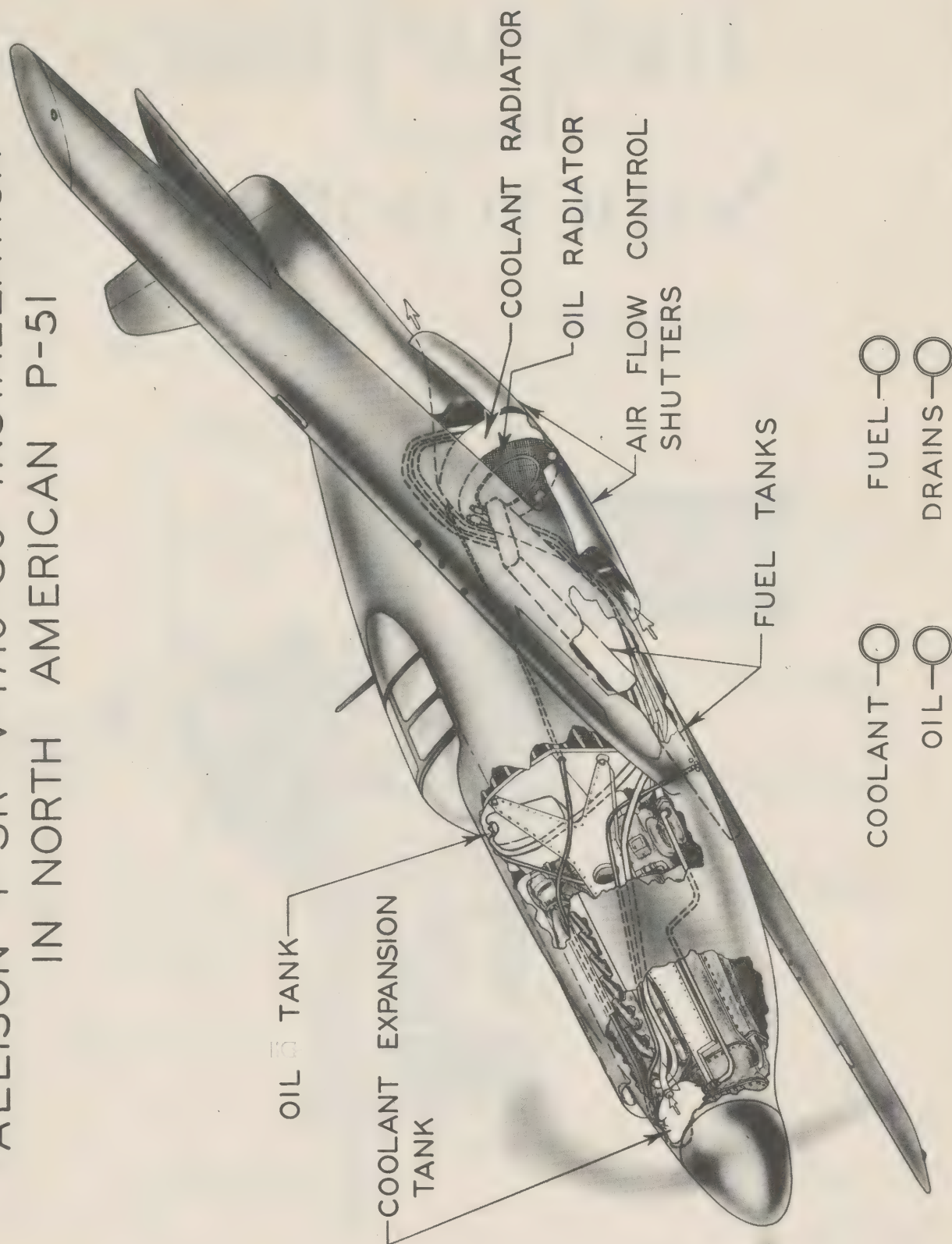
- PRESSURE OIL-○
- SCAVENGE OIL-○
- BREATHER & VENT LINES-○
- FUEL LINES-○
- REDUCTION GEAR OIL-○
- FREE AIR FLOW-○

E-4 V-1710-35 FUEL SYSTEM IN BELL AIRACOBRA, P-39

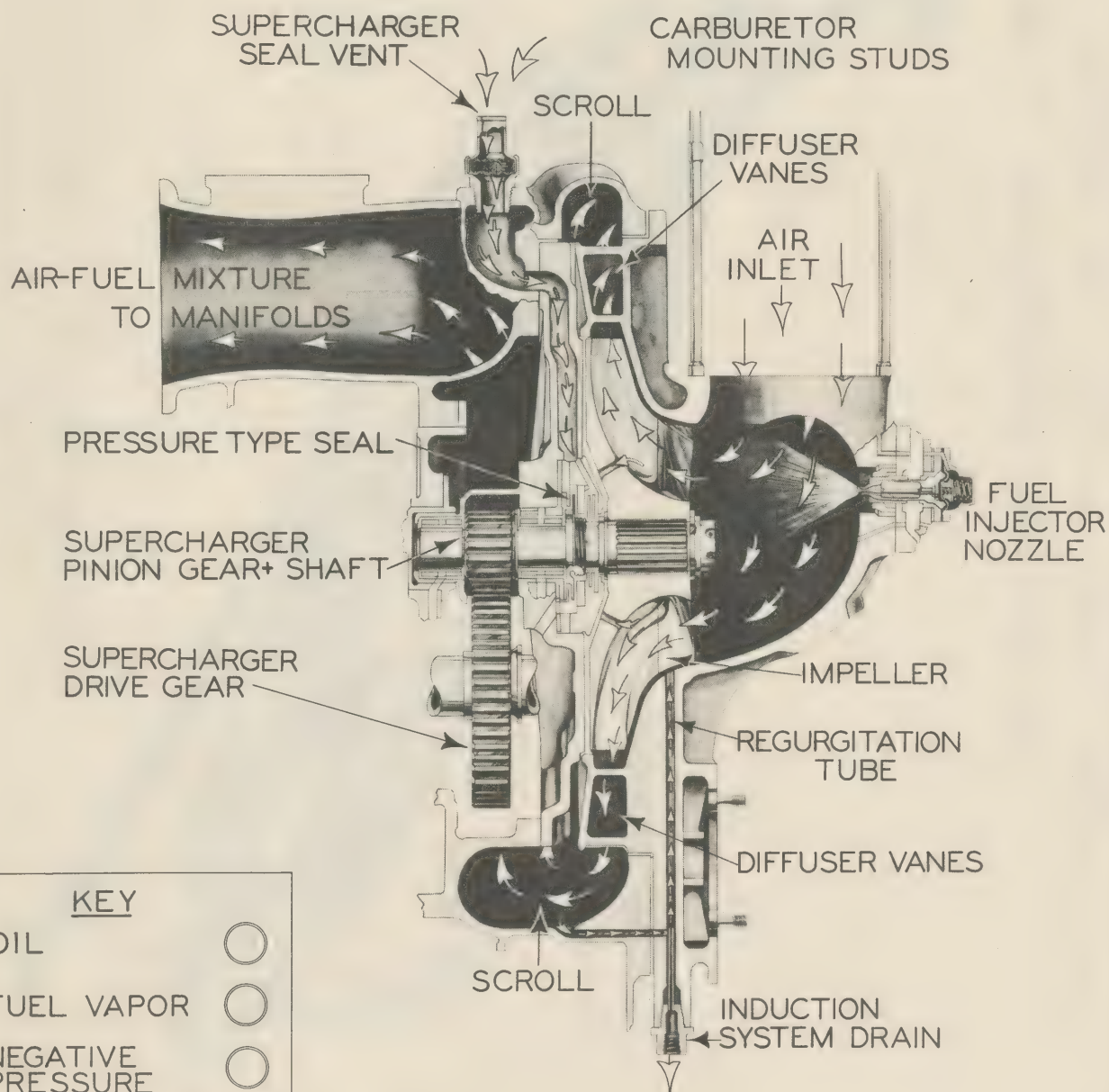
FUEL LINES—○ VENT LINES—○ DRAINS—○ MANIFOLD PRESSURE—○
CARBURETOR AIR PRESSURE—○



ALLISON F-3R V-1710-39 INSTALLATION IN NORTH AMERICAN P-51



Fuel-Air Flow through Supercharger

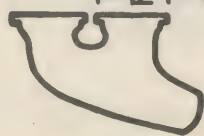


6-10-62 DEB-WER
SS.-B 28

EXHAUST FLAMES

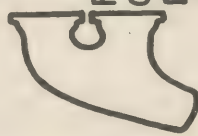
CHARACTERISTICS

And Their



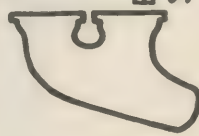
OVER LOADED (GENERAL)

NOTICED ONLY WHEN STARTING. THICK, BLACK, BILLOWY SMOKE, OFTEN FOLLOWED BY FIRE FROM STACKS, THIS TYPE IS CAUSED BY OVER PRIMING, CONSTITUTES A DANGEROUS FIRE HAZARD, AND IS DETRIMENTAL TO THE ENGINE.



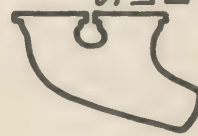
RICH MIXTURE (GENERAL)

ENGINE SPEED-2500 R.P.M. SHORT, RED FLAME AT STACK, FOLLOWED BY AN AREA OF NO NOTICEABLE FLAME, THEN AN AREA BLUISH IN COLOR. IF VERY RICH, A BLACK, SOOTY SMOKE WILL BE NOTICED. AS MIXTURE IS CORRECTED, THE BLUISH FLAME WILL MOVE INWARD.



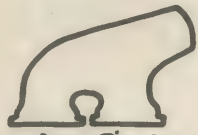
LEAN MIXTURE (GENERAL)

ENGINE SPEED - 2000 R.P.M. LEAN MIXTURE IS INDICATED BY A BLUISH, WHITE FLAME DIRECT FROM STACKS. ENGINE TENDS TO BACK FIRE AT HIGHER SPEEDS. AVERAGE LENGTH OF FLAMES, 6 TO 8 INCHES.

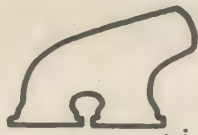


OIL FLAME (GENERAL OR LOCAL)

ENGINE SPEED-2500 R.P.M. A SHORT, SNAPPY, DULL RED FLAME. AVERAGE LENGTH, 4 TO 7 INCHES. USUALLY ACCOMPANIED BY WHITISH, BILLOWY SMOKE. THIS FLAME MAY BE NOTICED IN ONE SET OF STACKS AND BE ENTIRELY LACKING IN ANOTHER.



LEAN MIXTURE & BURNING OIL
REDDISH FLAME WITH BLUISH TIP. ONE OF THE MOST COMMON FLAMES ENCOUNTERED. OFTEN CONFUSED WITH OIL FLAME. TO CHECK, MOVE MIXTURE CONTROL TO FULL RICH POSITION. IF FLAME LESSENS, MIXTURE IS LEAN & BURNING OIL. AVERAGE LENGTH 6 TO 8 IN.

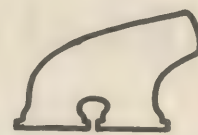


DEFECTIVE SPARK PLUGS
INDICATES DETONATION. ENGINE SPEED-2500 R.P.M. VERY LONG WHITISH, ORANGE FLAME APPEARING INTERMITTENTLY. INCLINED TO BE SPASMODIC OR EXPLOSIVE IN APPEARANCE. USUALLY APPEARS FROM ONE OR MORE STACKS.



INCOMPLETE COMBUSTION (GEN)

BLUISH, WHITE FLAME DANCES OUT FROM STACK. USUALLY NOTICED WHEN TAKING A MAG. CHECK. CAUSED BY INCOMPLETE BURNING OF FUEL/AIR MIXTURE IN COMBUSTION CHAMBER. A DROP IN R.P.M. MAY ALSO BE NOTICED.



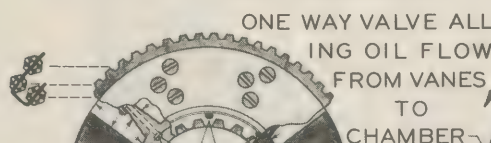
CORRECT MIXTURE (USUALLY GEN.)

ENGINE SPEED - 2600 R.P.M. A SHORT, SNAPPY, BLUISH PURPLE FLAME. AT TIMES DEPENDING ON LIGHTING CONDITIONS, THIS FLAME MAY BE VERY HARD TO DISTINGUISH.

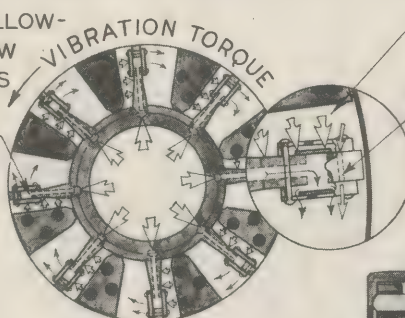
DIAGRAM VIBRATION DAMPER, V-1710-27&29

ENGINE OIL (65 LBS. PRESSURE)

REACTION OF OIL PRESSURE DUE TO SUDDEN CHANGE OF DIRECTION

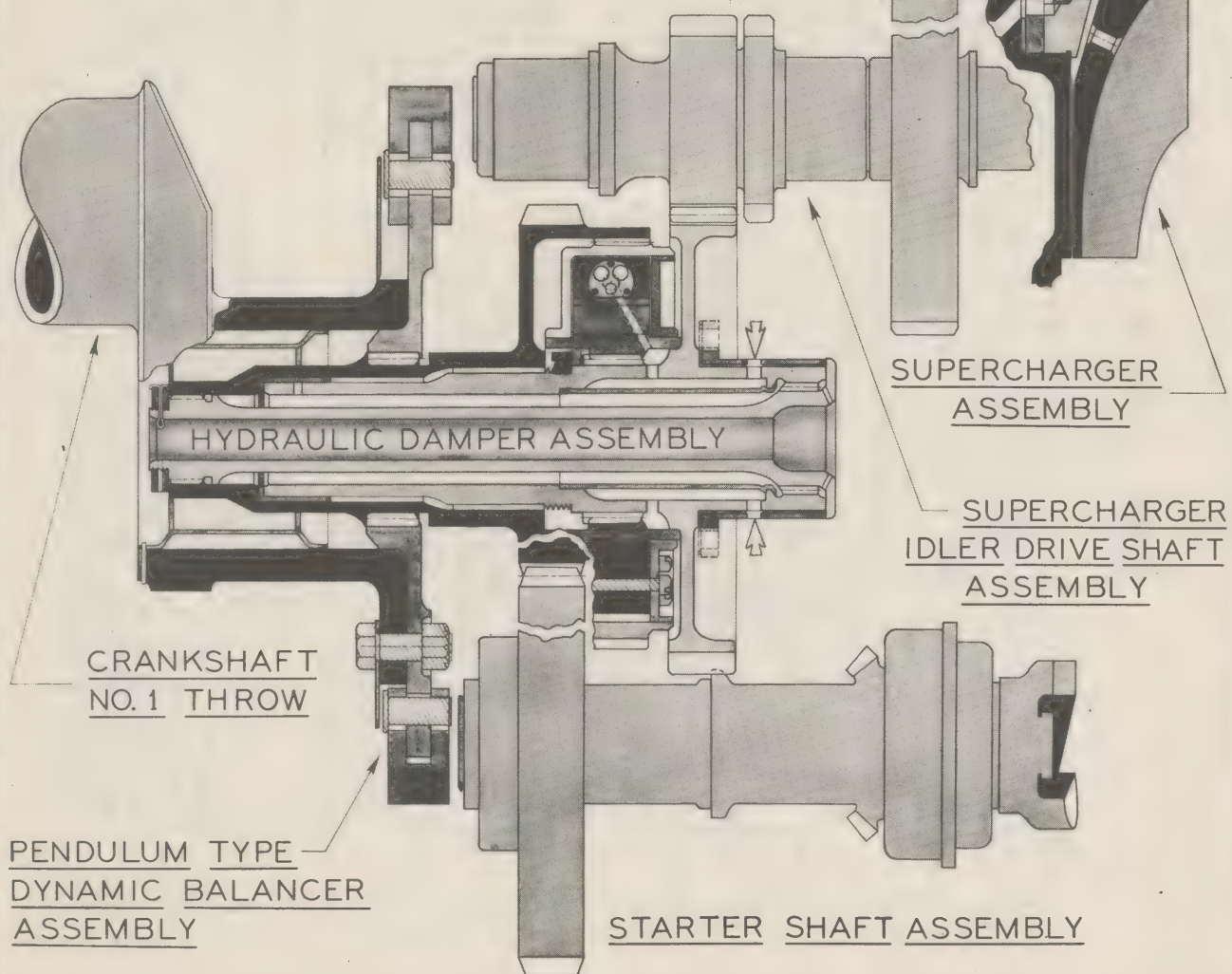


UNDISTURBED POSITION

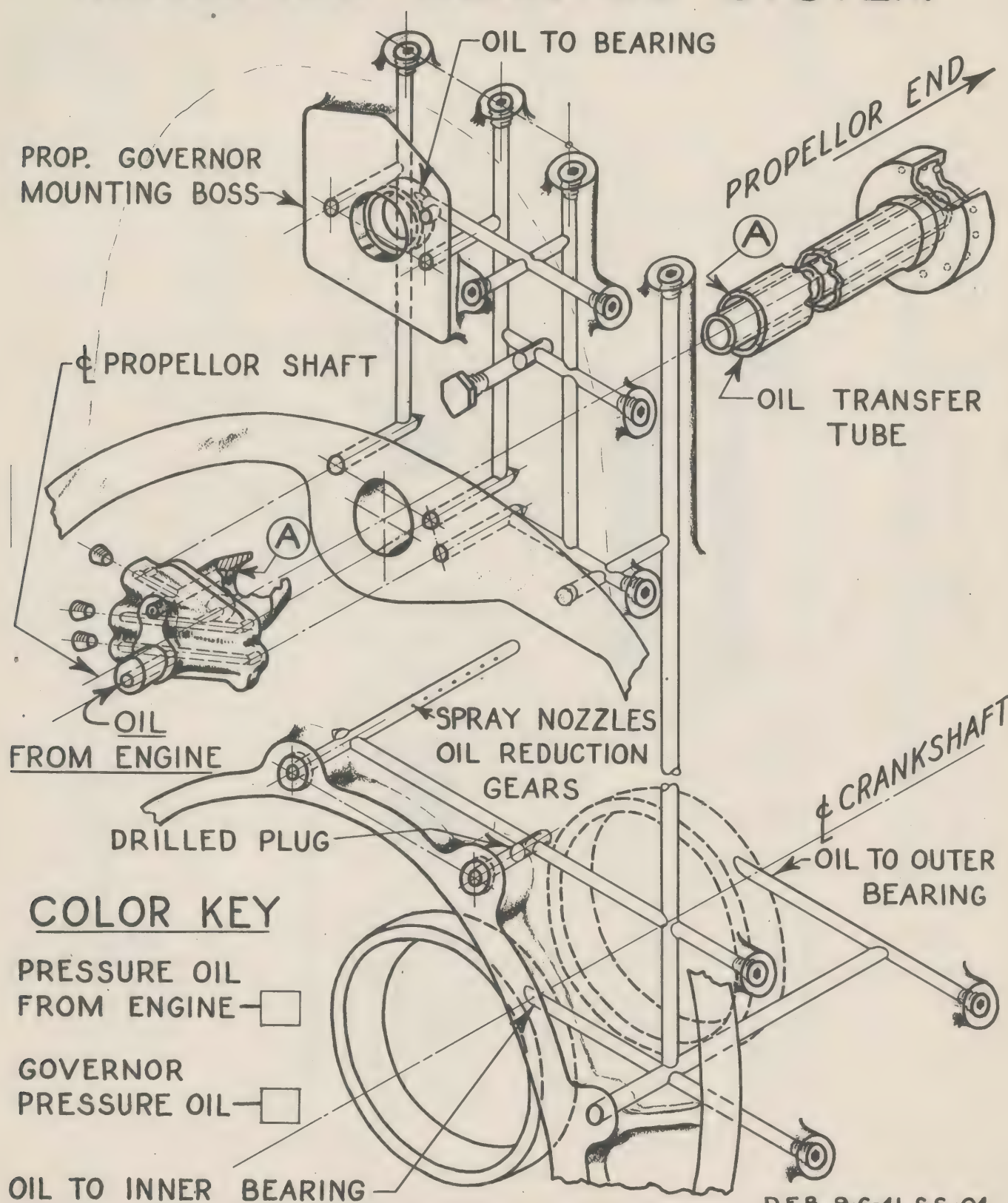


DISTURBED POSITION

OPERATION OF HYDRAULIC DAMPER

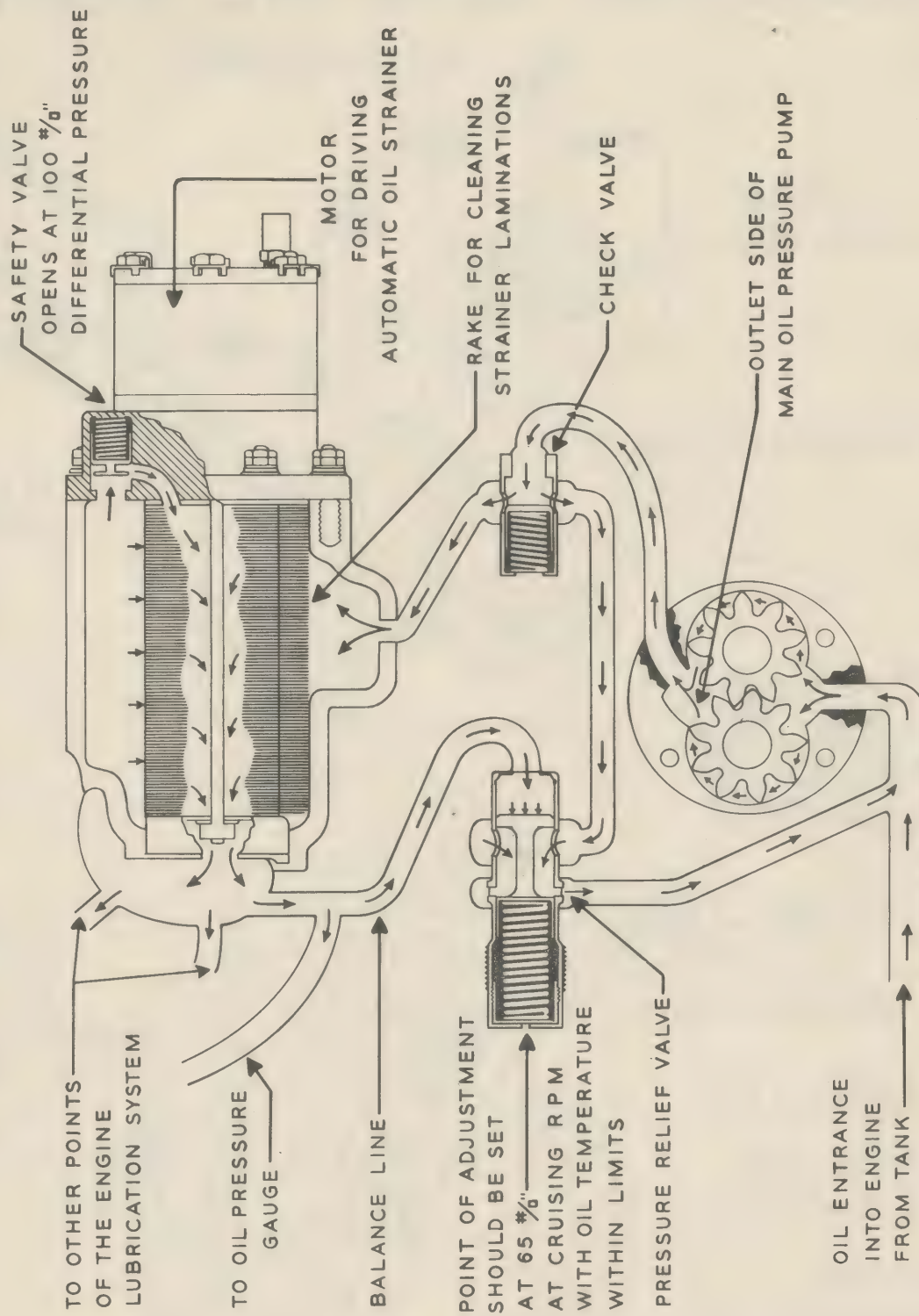


ALLISON V-1710 F-R&L TYPE REDUCTION GEAR OIL SYSTEM



D.E.B., 9-6-41, S.S.-04

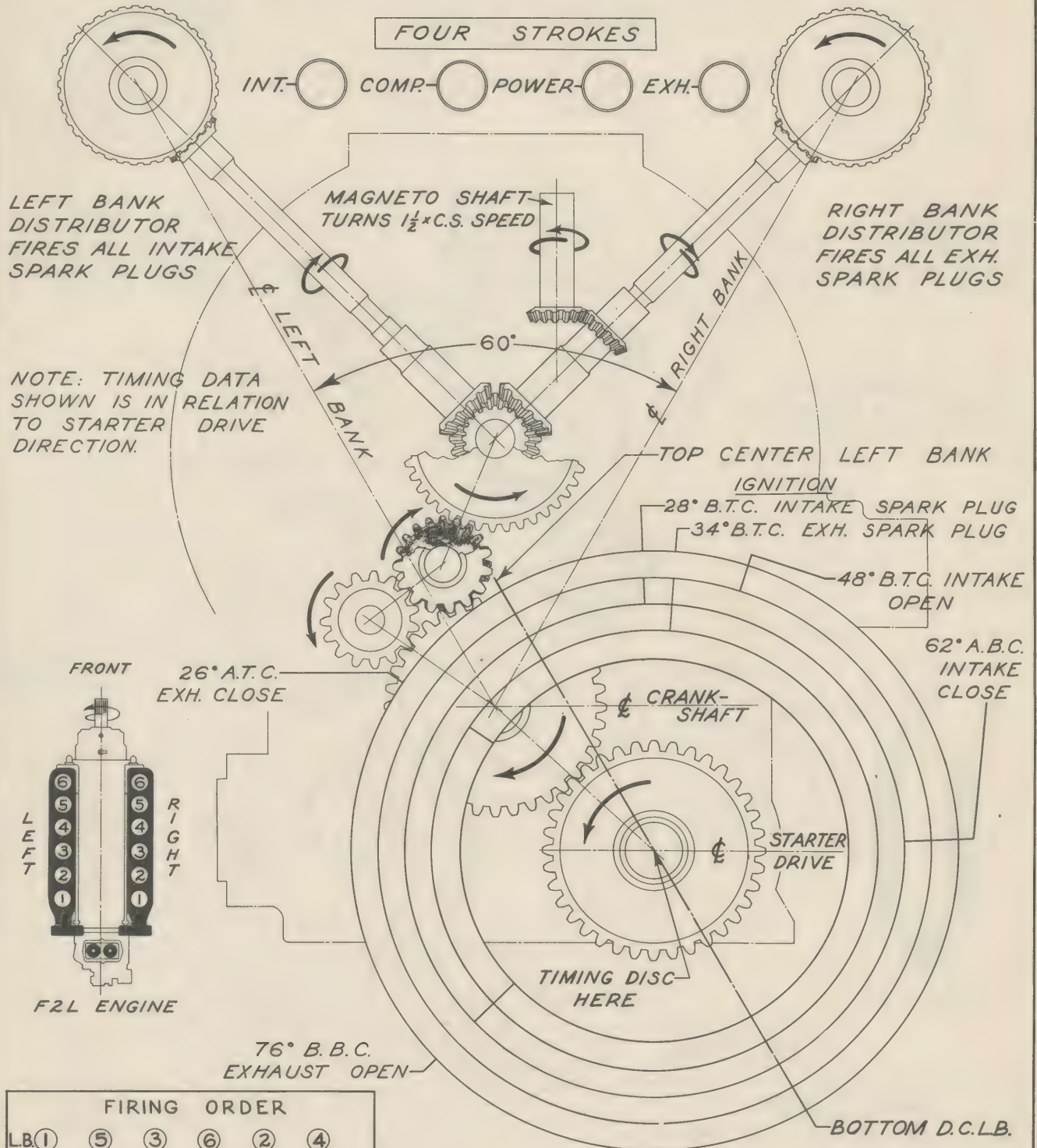
RELATIONSHIP OF OIL PUMP, OIL STRAINER AND PRESSURE RELIEF VALVE



5-22-42 S.S.-015
L.O.P.

ALLISON V-1710-F2L ENGINE VALVE & IGNITION TIMING

CYLINDER NOS., PROP. & OTHER SHAFT ROTATIONS
TAKEN AS FACING ACCESSORY END



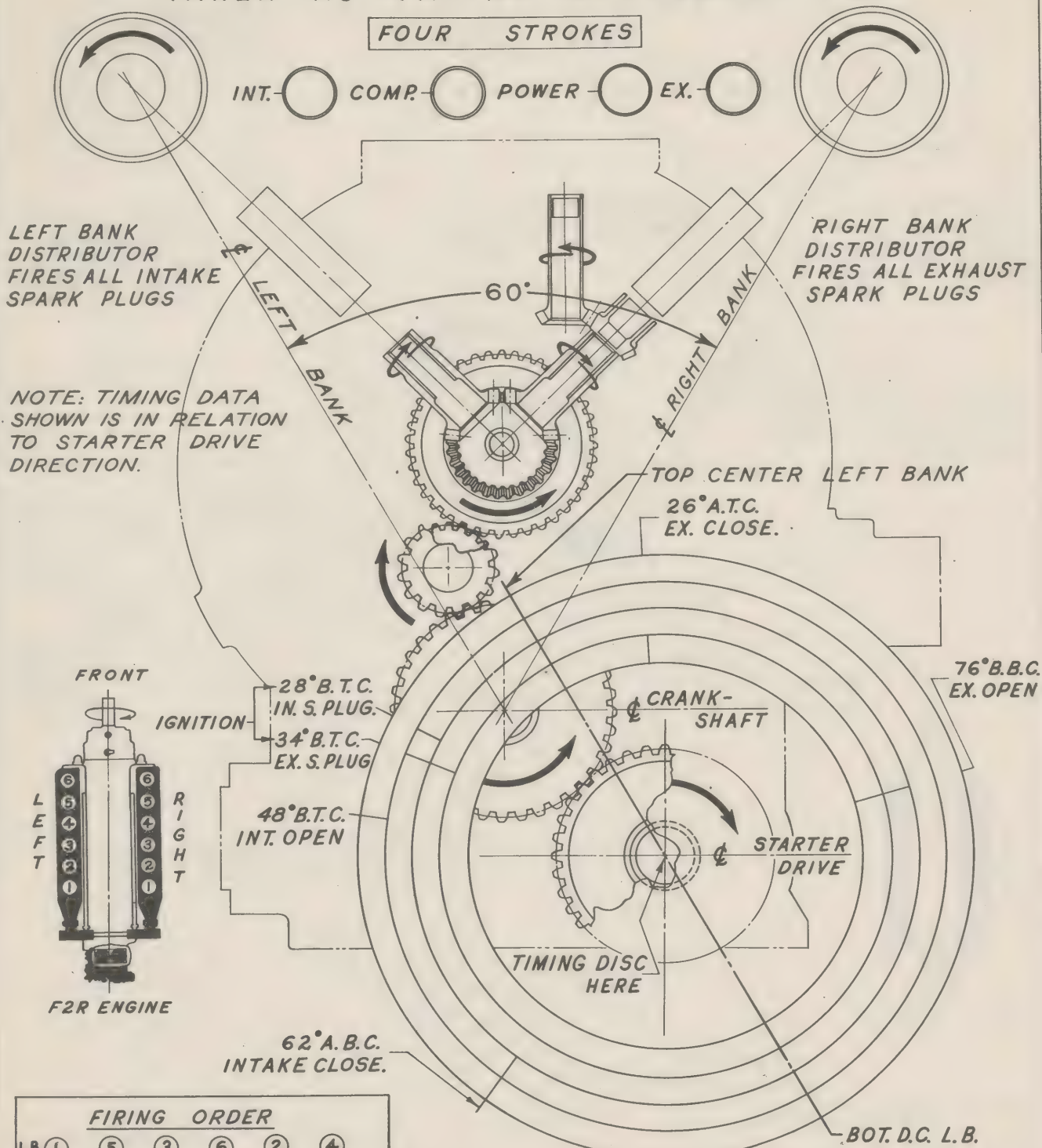
VALVE TAPPET CLEARANCE:
(COLD) INTAKE-.015" EXHAUST-.020"

S.S.-B12

REV. 5-5-41 REV. 8-13-41 S.S. 5-23-41 D.E.B.

ALLISON V-1710-FR & E ENGINES VALVE & IGNITION TIMING

CYLINDER NOS. PROP. & OTHER SHAFT ROTATIONS
TAKEN AS FACING ACCESSORY END



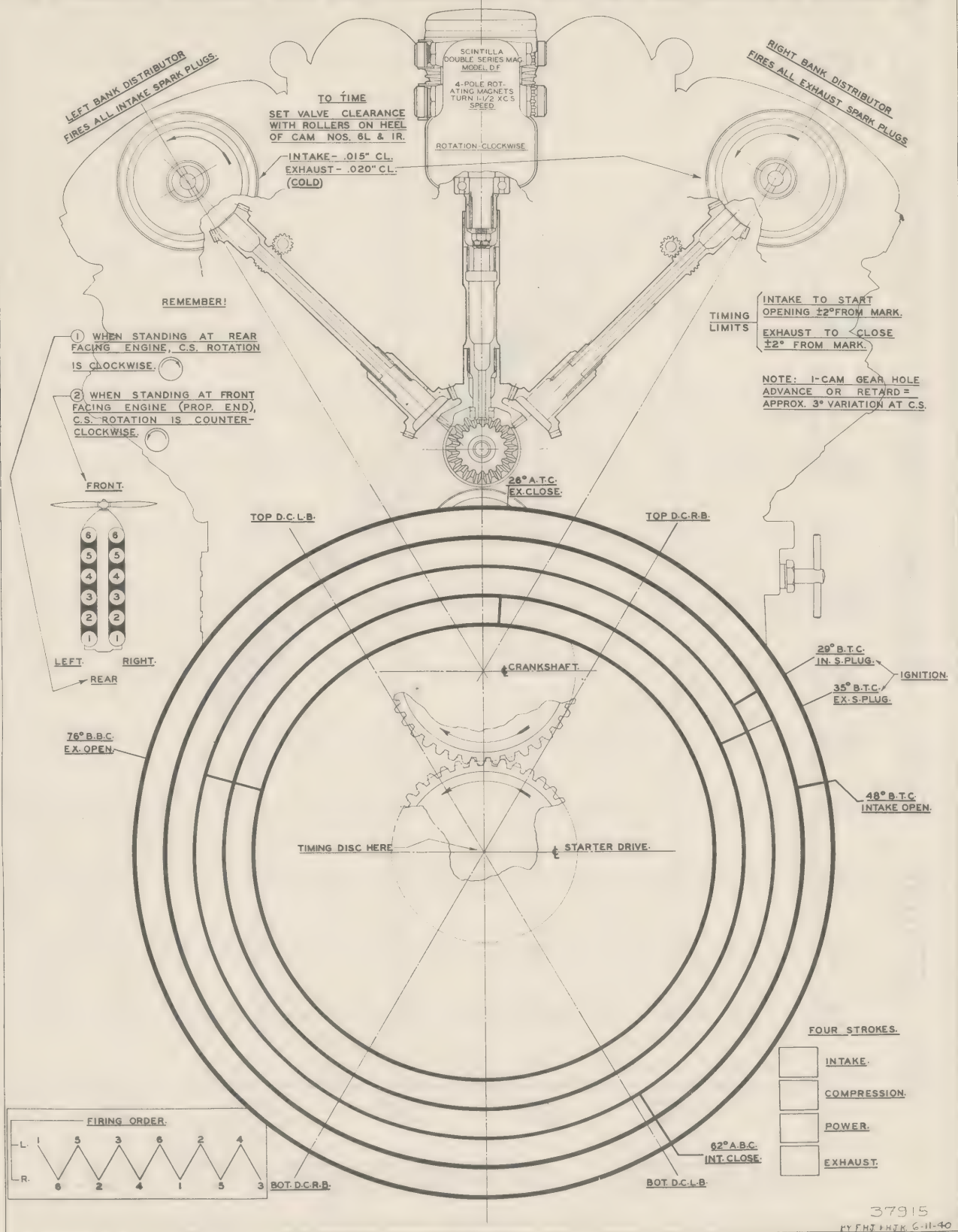
VALVE TAPPET CLEARANCE:
(COLD) INTAKE .015" EXHAUST .020"

REV-5/12-61 1-23-61 L.C.B.

ALLISON VI710-C15 ENGINE.

VALVE & IGNITION TIMING.

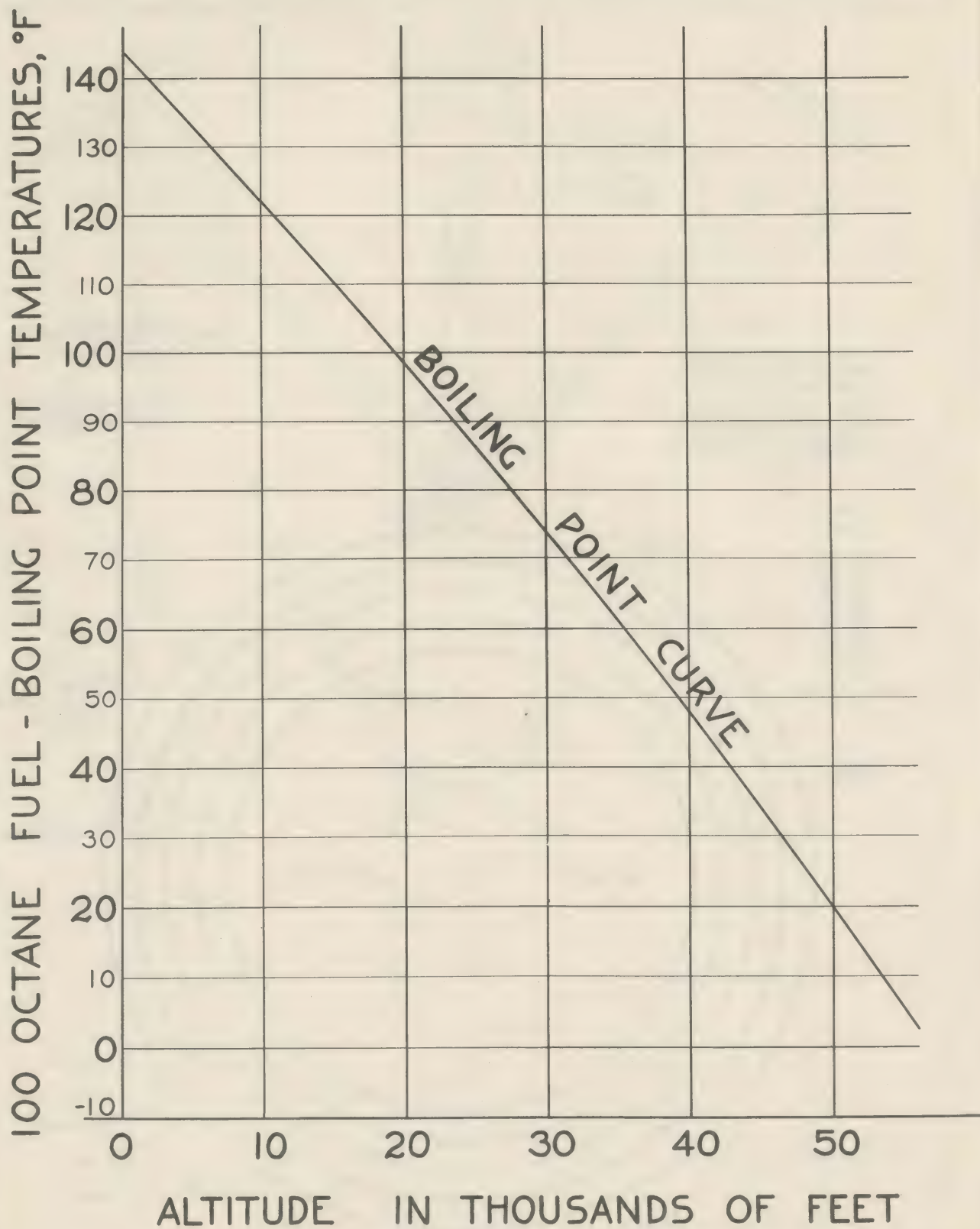
LEFT BANK AND RIGHT BANK DESIGNATION AND CYL. NOS., PROP AND OTHER SHAFT ROTATIONS, TAKEN AS STANDING AT ACCESSORY DRIVE END, FACING ENGINE. FRONT END IS PROP END; REAR IS ANTIPROP END.



37915

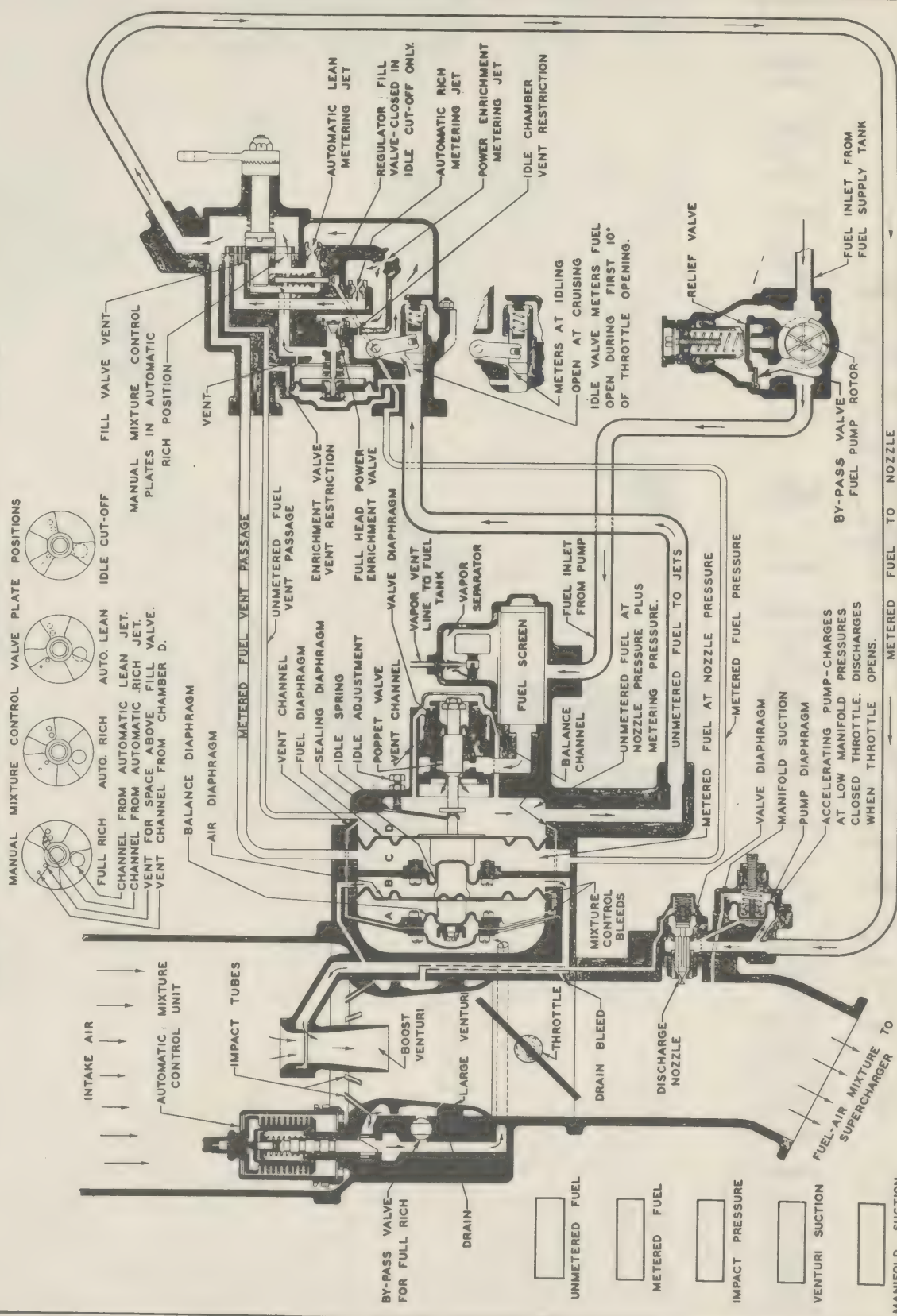
FY FHT HTH 6-11-40

FUEL CHARACTERISTICS AT ALTITUDE



STROMBERG INJECTION CARBURETOR

WITH FUEL HEAD ENRICHMENT VALVE



CURTISS P-40D & E INSTRUMENT PANEL & CONTROLS

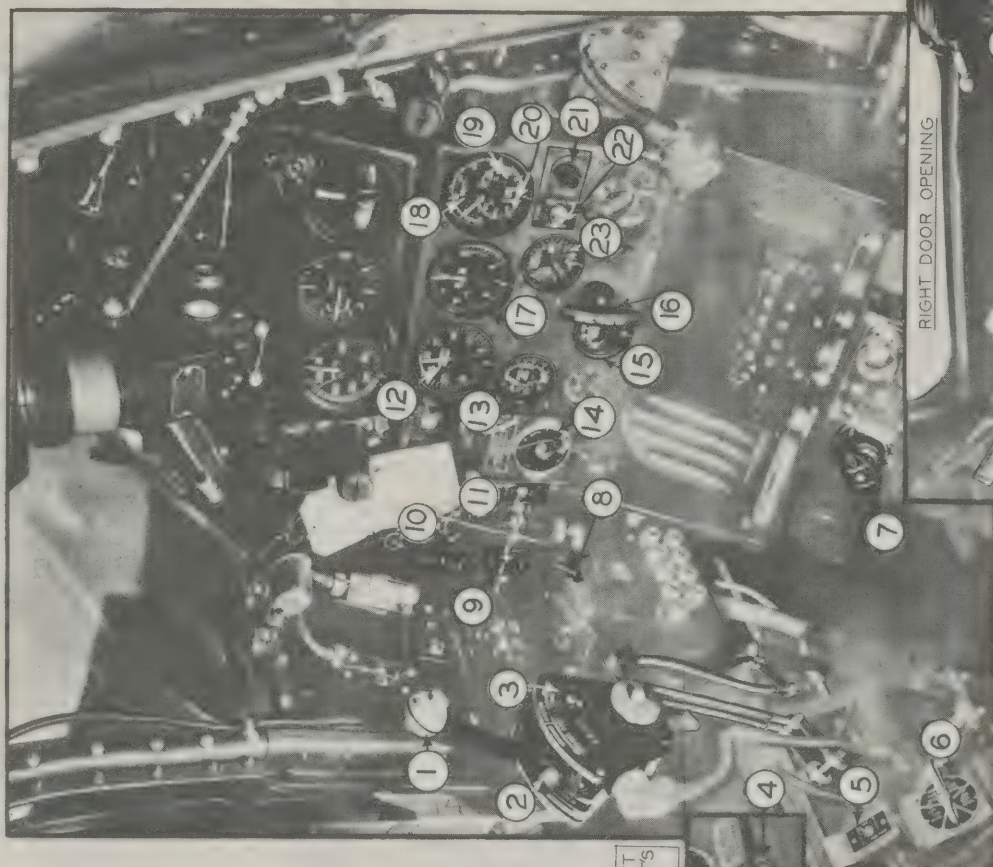


- 1-THROTTLE
- 2-MANUAL MIXER CONTROL
- 3-FUEL TANK SELECTOR
- 4-PROPELLER GOVERNOR CONTROL
- 5-FUEL SIGNAL
- 6-FUSELAGE FUEL TANK GAGE
- 7-PARKING BRAKE
- 8-ELECTRIC FUEL PUMP SWITCH
- 9-PROPELLER CIRCUIT BREAKER
- 10-PROPELLER CONTROL SWITCH
- 11-IGNITION SWITCH
- 12-OIL DILUTION SWITCH
- 13-PRESTONE AND FUEL TEST SWITCH
- 14-GENERATOR SWITCH
- 15-FUEL GAGE LIGHTS CHECK SWITCH
- 16-STARTER SWITCH
- 17-MAIN FUEL TANK GAGE
- 18-ENGINE PRIMER
- 19-RESERVE FUEL TANK GAGE
- 20-TACKOMETER
- 21-MANIFOLD PRESSURE GAGE
- 22-COOLANT WARNING LIGHT
- 23-COOLANT TEMPERATURE GAGE
- 24-OIL TEMPERATURE GAGE
- 25-OIL PRESSURE GAGE
- 26-FUEL PRESSURE GAGE
- 27-CARBURATOR HEAT CONTROL
- 28-CIRCUIT BREAKERS
- 29-OIL-COOLANT SHUTTER CONTROL

6-942 WEH
SS-023

BELL P-39 F INSTRUMENT PANEL & CONTROLS

- 1 THROTTLE
- 2-MANUAL MIXER CONTROL
- 3-PROPELLER GOVERNOR CONTROL
- 4-CARBURATOR HEAT CONTROL
- 5-ELECTRIC FUEL PUMP SWITCH
- 6-FUEL TANK SELECTOR
- 7-ENGINE PRIMER
- 8-OIL DILUTION SWITCH
- 9-PROPELLER CONTROL SWITCH
- 10-PROPELLER CIRCUIT BREAKER
- 11-GENERATOR SWITCH
- 12-MANIFOLD PRESSURE GAGE
- 13-FUEL TANK GAGE
- 14-IGNITION SWITCH
- 15-COOLANT TEMPERATURE GAGE
- 16-PARKING BRAKE
- 17-TACKOMETER
- 18-OIL TEMPERATURE GAGE
- 19-FUEL PRESSURE GAGE
- 20-OIL PRESSURE GAGE
- 21-FUEL PRESSURE WARNING
- 22-FUEL PRESSURE TEST SWITCH
- 23-OIL PRESSURE GAGE-REDUCTION GEAR
- 24-STARTER SWITCH
- 25-COOLANT SHUTTER CONTROL
- 26-OIL SHUTTER CONTROL



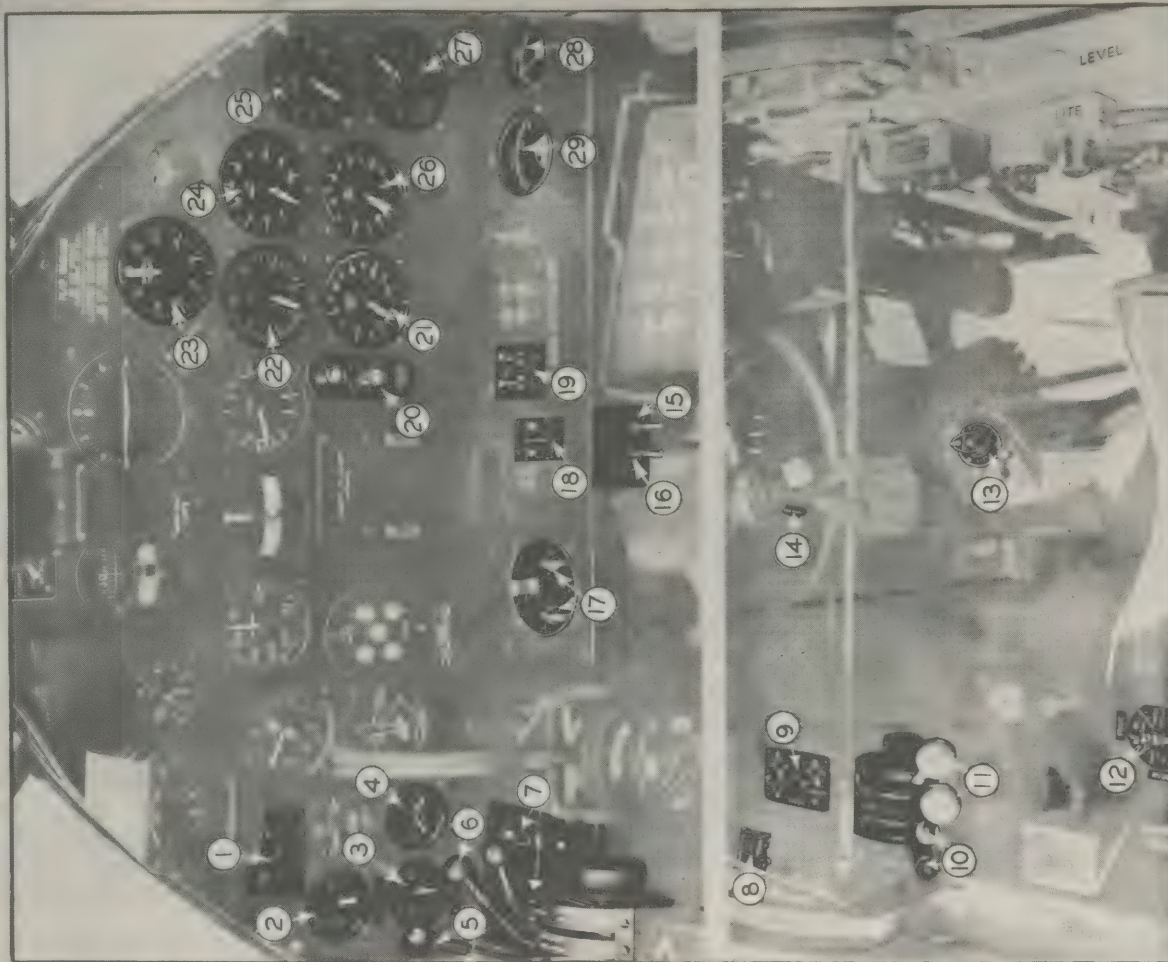
LOCATED LEFT
REAR OF PILOT'S
SEAT

RIGHT DOOR OPENING

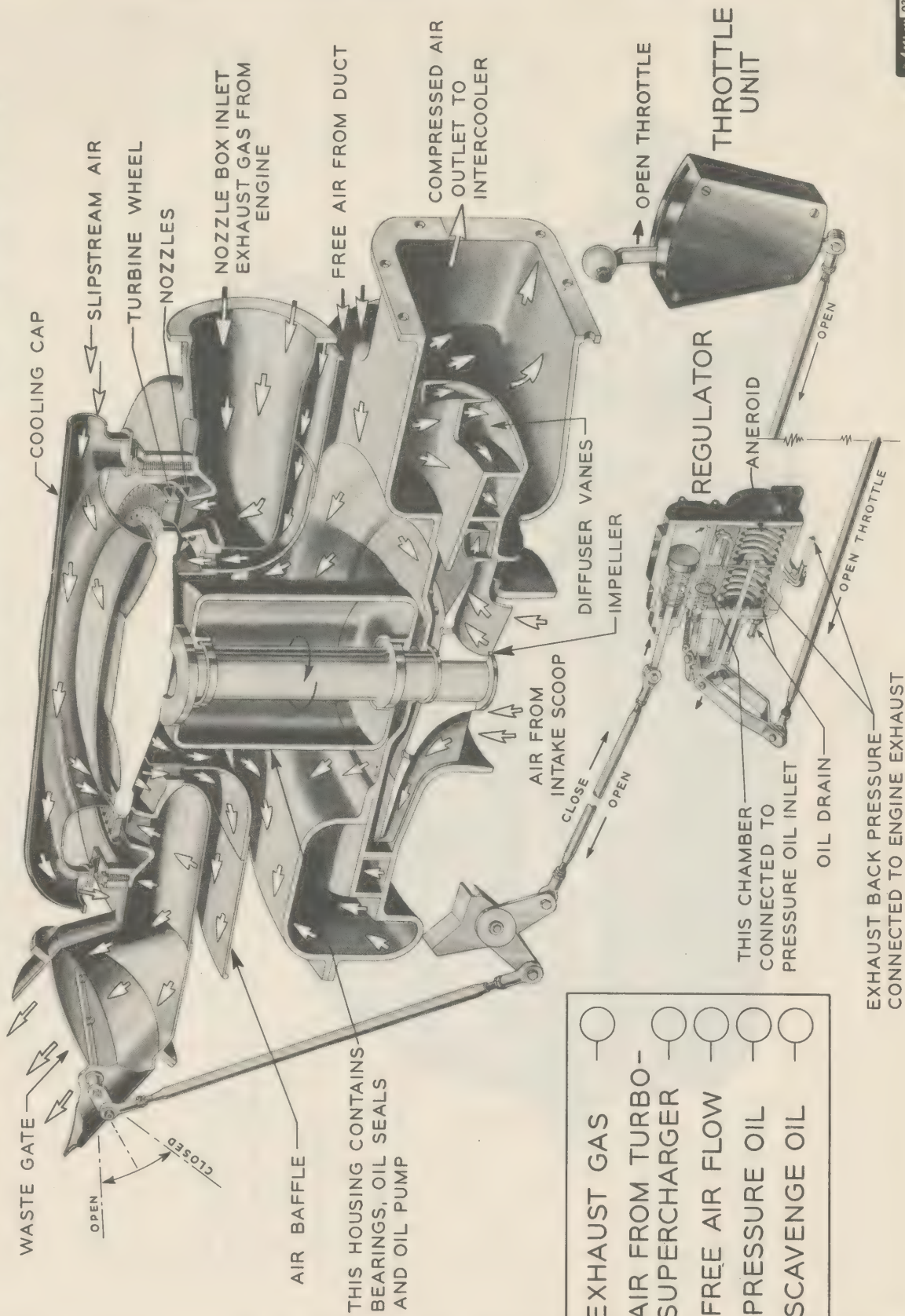
7-2-42
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LOCKHEED P-38 E INSTRUMENT PANEL & CONTROLS

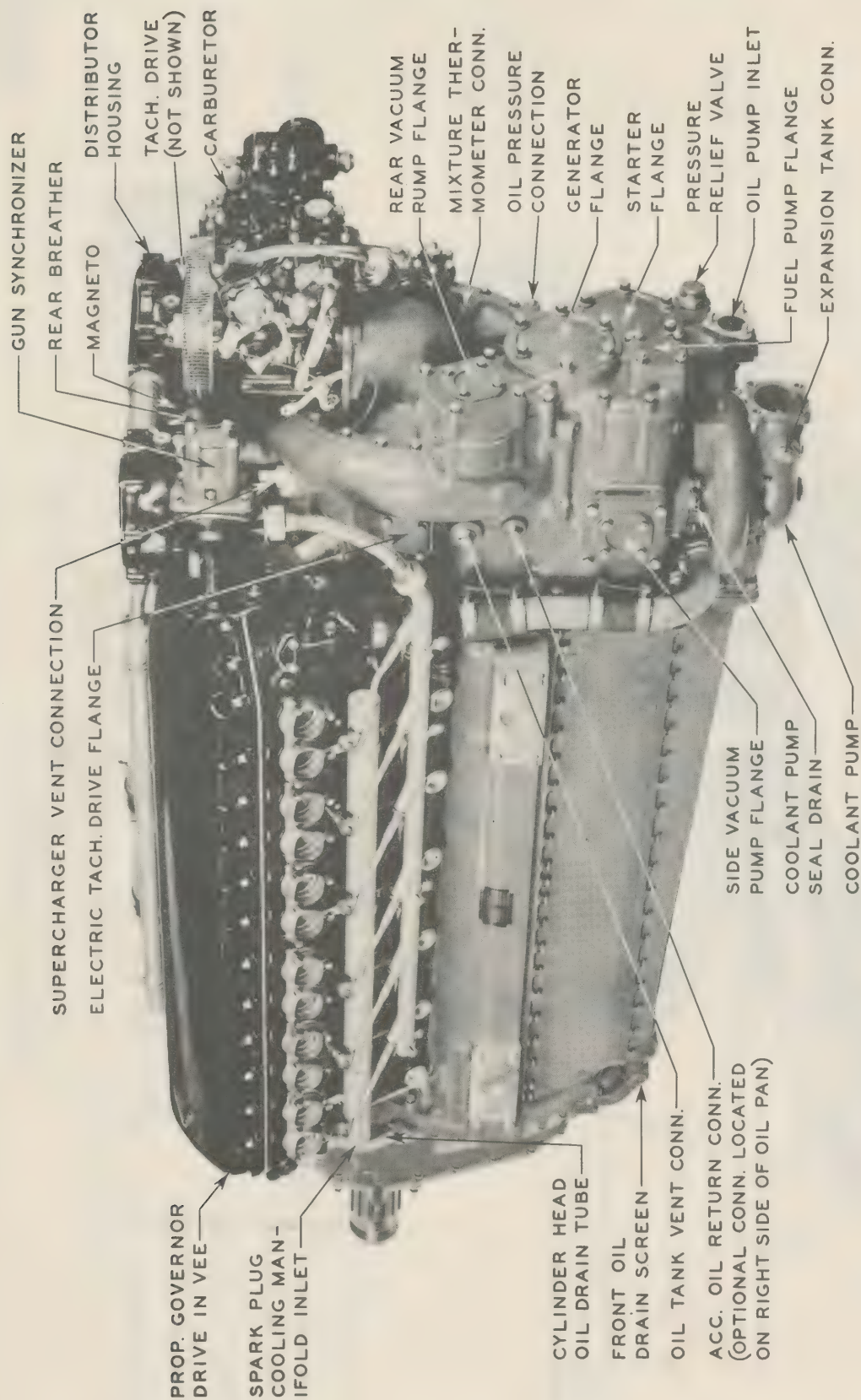
- 1-FUEL PRESSURE WARNING
- 2-RESERVE FUEL TANK GAGES
- 3-MAIN FUEL TANK GAGES
- 4-OIL SHUTTER POSITION INDICATOR
- 5-PROPELLER GOVERNOR CONTROLS
- 6-COOLANT SHUTTER CONTROLS
- 7-PROPELLER CIRCUIT BREAKERS
- 8-PROPELLER FEATHER SWITCHES
- 9-PROPELLER CONTROL SWITCHES
- 10-MANUAL MIXER CONTROL
- 11-THROTTLES
- 12-FUEL TANK SELECTOR
- 13-ENGINE PRIMER
- 14-PARKING BRAKE
- 15-GENERATOR SWITCH
- 16-OIL SHUTTER SWITCH
- 17-IGNITION SWITCHES
- 18-OIL DILUTION SWITCHES
- 19-STARTER SWITCHES
- 20-COOLANT TEMPERATURE WARNING
- 21-COOLANT TEMPERATURE GAGE
- 22-TACKOMETER
- 23-MANIFOLD PRESSURE GAGE
- 24-OIL PRESSURE GAGE
- 25-FUEL PRESSURE GAGE
- 26-OIL TEMPERATURE GAGE
- 27-CARBURATOR AIR TEMPERATURE GAGE
- 28-VOLTMETER
- 29-AMMETER



TURBO-SUPERCHARGER AND REGULATOR

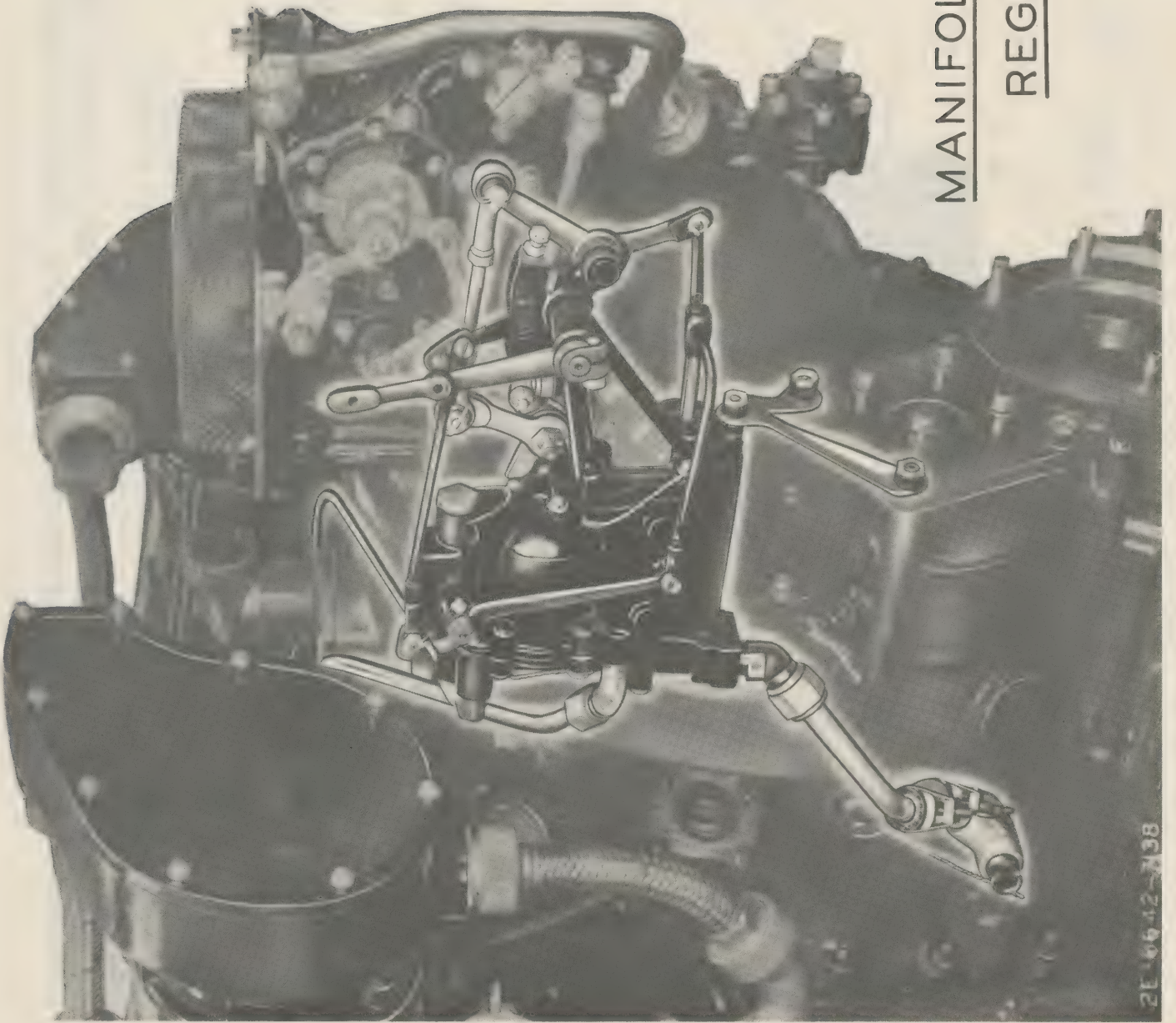


- EXHAUST GAS
- AIR FROM TURBO-SUPERCHARGER
- FREE AIR FLOW
- PRESSURE OIL
- SCAVENGE OIL



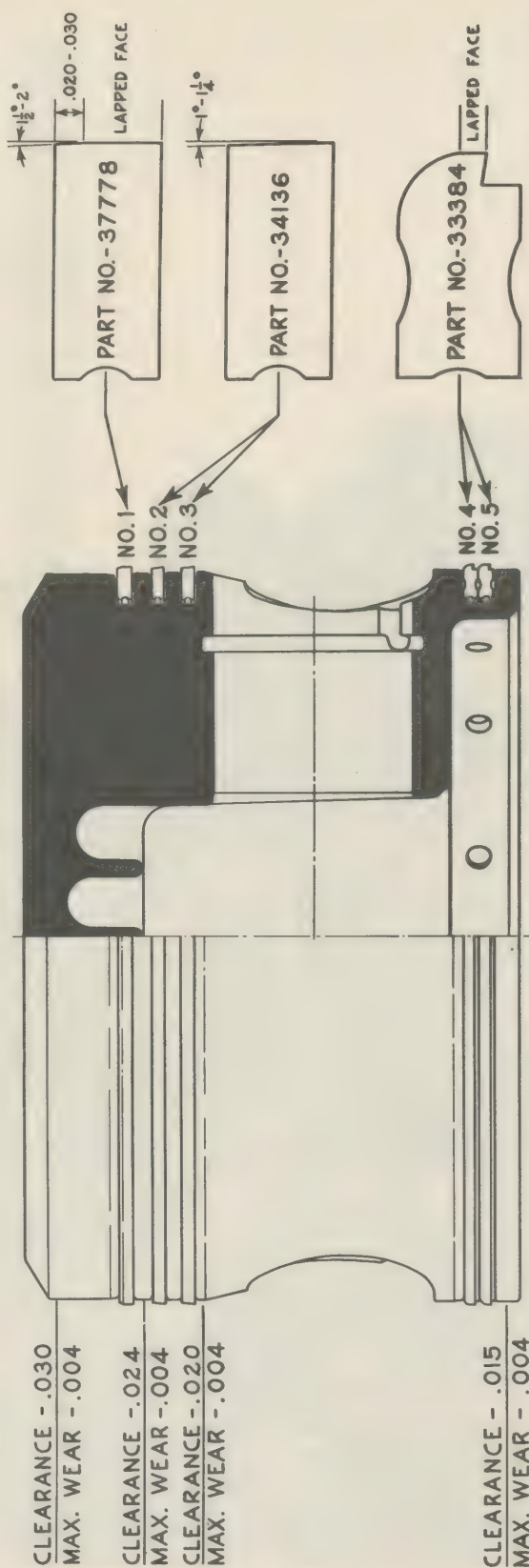
LOCATION OF ACCESSORIES & CONNECTIONS V-1710-39 ENGINE

MANIFOLD PRESSURE REGULATOR



2E166-12-2438

PISTON RING PLACEMENT DIAGRAM



CLEARANCE OF PISTON PIN IN PISTON-.000
MAXIMUM WEAR-.0008

THE RING ORDER SHOWN ABOVE
IS FOR 'E' AND 'F' ENGINES.

RING ORDER FOR C-15 ENGINES

THIS ORDER WENT INTO EFFECT JAN. 30, 1941.

NO. 1 RING	-	PART NO. 37778
NO. 2 RING	-	PART NO. 37778
NO. 3 RING	-	PART NO. 34136
NO. 4 RING	-	PART NO. 33384
NO. 5 RING	-	PART NO. 33384

FOR NEW RINGS- THE WORD 'TOP' IS ETCHED ON TOP SIDE TO INDICATE INSTALLATION POSITION.

FOR OLD RINGS- THE WORD 'TOP' MAY BE OBLITERATED, HENCE THE TAPER SHOULD BE OBSERVED AND INSTALLED AS SHOWN.

WEIGHT OF PISTON - NO-41380 - NO-36380
NORMAL WEIGHT - 3.715 LBS. - 3.680 LBS.
VARIATION ALLOWED - ± 0.015 LBS. - ± 0.015 LBS.

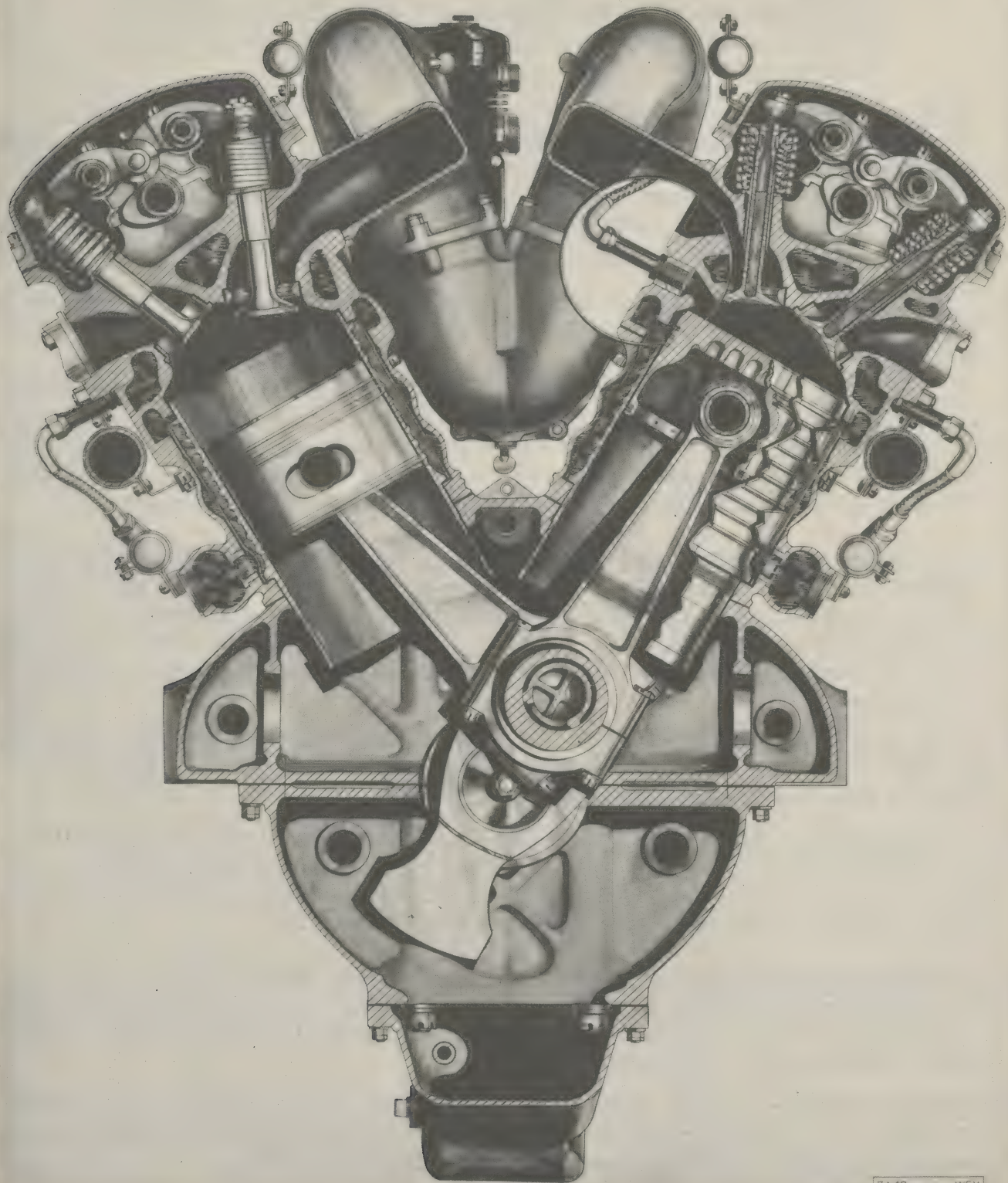
THE RING GAP IS .020-.028 ON ALL RINGS.

PISTON RING SIDE CLEARANCES

FOR ALL ENGINES

NO. 1 RING	-	.0065	-	.008
NO. 2 RING	-	.005	-	.0065
NO. 3 RING	-	.002	-	.0035
NO. 4 RING	-	.002	-	.005
NO. 5 RING	-	.002	-	.005

ENGINE CROSS-SECTION THROUGH NO 6 CYLINDERS



7-142 WEH
SS-B29

ALLISON ENGINE LOCATIONS AND INSTALLATIONS

This series of charts and diagrams deal with the C, F and E models of Allison aircraft engines. The basic element in each of these models is a 1710 cubic inch, V-type, 12-cylinder, high temperature liquid-cooled engine incorporating a single stage supercharger.

1. C-15 Engine Lubrication System: This diagram shows the arrangement of pressure and scavenge oil systems in the C-15 (V-1710-33) engine. The combination pressure and scavenge oil pump, located on the accessories drive housing, and an auxiliary scavenge pump housed in the nose section constitute the working parts of a dry-sump system that provides constant pressure to all plain bearing surfaces throughout the engine.
2. C-15 Installation in Curtiss P-40: The Curtiss P-40, pictured here, was one of the earliest airplanes to be powered with the Allison engine. It carries the C-15 model engine.
3. C-15 Coolant System in P-40: The Curtiss P-40 coolant system incorporates two radiators, located on either side of the oil radiator beneath the engine, and an expansion tank mounted behind the engine. The cooling medium used in the engine is Ethylene Glycol. The flow of coolant is indicated by the lines leading to and from the coolant pump located on the rear under side of the engine.
4. C-15 Lubrication System in P-40: This diagram of the Curtiss P-40 lubrication system, shows the arrangement of pressure and scavenger lines to and from the engine, the location of tank and cooling radiator, and the connection of the oil pressure and temperature gage. The Oil Dilution Control, indicated in the lower view, is employed to dilute the oil with gasoline when cold weather starting is anticipated.
5. C-15 Fuel System in P-40: This diagram of the P-40 fuel system shows the gasoline tanks, fuel lines, breather and vent lines, drains and manifold pressure lines in their relative locations in the aircraft.
6. C-15 Electrical System in P-40C: This is a diagrammatic drawing of the C-15 installation in the Curtiss P-40C, showing location of the various units of the ignition and electrical systems and the controls for them. In the lower right-hand corner is a wiring diagram of the starter system.
7. F-Type Engine Lubrication System: This chart shows the pressure and scavenger oil passages and drains in the accessory housing, crankcase, cylinder block assembly and reduction gear. Also shown is the propeller governor oil pressure in the reduction gear and propeller shaft.
8. P-40D Installation Chart: This installation chart shows engine location in the P-40D, coolant and oil radiators, gasoline and oil tanks, lines and breathers, as well as installation stations designated by encircled letters.

9. Curtiss P-40D Coolant System: By reference to the color key, trace coolant flow from the pump through engine system and radiators. Expansion tank, expansion line, vent lines and drains are also shown. Note cockpit gage, warning signal and radiator shutter control.
10. F-3R Lubrication System in the P-40D and E: This chart shows the lubrication system for the F-3R engine as installed in the P-40D and E airplane. Also shown are various installation details and connections.
11. Curtiss P-40D and E Fuel System (Engine Compartment): Shows differences in installation occasioned by use of an electric auxiliary fuel pump. Detail drawings show vapor control valve, vapor eliminator and fuel strainer.
12. Curtiss P-40D and E Fuel System (Tanks): The diagram shows placement of tanks, arrangement of feed and vent lines, drain cocks and plugs, tank selector valve, gages and control switches.
13. Curtiss P-40D and E Electrical System: Details of the ignition and electrical system in the P-40D and E are shown in this diagram. Note various units in each circuit ("A" through "H").
14. Lockheed P-38 Installation: The Lockheed P-38 interceptor plane, an extremely fast ship, is powered with two Allison F-2 engines, rotating in opposite directions. The P-38 is equipped with a turbo exhaust-driven supercharger for each engine, enabling it to maintain exceptional efficiency at great altitude.
15. Lockheed P-38 Coolant System: The coolant system employed in the P-38 is noteworthy by reason of the location of the coolant radiators in the tail booms, remote from the engine. There is a separate, self-contained coolant system for each engine. Note location of expansion tank, two radiators in each tail boom and other details covered by reference list.
16. Lockheed P-38 Lubrication System: With aid of color key, trace flow of oil from tank through engine and radiators. Note details of thermostatic by-pass valve on radiators, and fact that each of the ship's two engines has its own oil system.
17. E-4 Engine Installation in Bell P-39: The Bell P-39, commonly known as the "Airacobra", is distinguished by numerous unconventional features. Among these is a 37.5 mm. cannon, firing through the propeller hub, lending this airplane the colorful name of "Cannon on Wings". Perhaps its most unique feature is its power plant. It employs an Allison model "E" engine, which is placed in the fuselage directly behind the pilot.
18. Bell P-39 Coolant System: By reference to color key and identifying letters, trace flow of coolant through engine and radiators, flow of cooling air, location of shutters and controls, and other details of installation, including expansion tank valve detail.

19. E-4 Lubrication System in P-39: This chart shows the lubrication system for both the engine and reduction gear box, also various installation connections and locations.
20. E-4 Fuel System in P-39: This chart shows fuel lines, vent lines, drains, manifold pressure and carburetor air pressure lines. Shown also are the gasoline tank locations and installation connections.
21. F-3R Installation in North American P-51: This chart shows engine, radiator, gasoline and oil tank locations, as used in the North American P-51, which is known in its British version as the Mustang and uses the F-3 engine.
22. Fuel-Air Flow Through Supercharger: Colored arrows show the flow of air and fuel from the pressure-type injector unit through the supercharger section to the intake manifolds. Of particular interest is the atmospheric pressure type oil seal around the supercharger impeller shaft.
23. Exhaust Flame Chart: A valuable aid in test stand operation and troubleshooting is the ability to diagnose engine difficulties from exhaust flame characteristics.
24. Diagram of Vibration Damper: The hydraulic vibration damper assembly used to protect the accessory and cam drives on E and F engines, consists essentially of an outer and an inner member connected by a flexible quill shaft, using engine oil pressure to absorb torsional shock that would otherwise be transmitted from the crankshaft to supercharger and other accessory drives.

Details of the hydraulic damper design, including flow of oil to inner member, are shown in this chart.
25. Allison F-Type Engine Reduction Gear Oil System: Color key indicates oil flow through drilled passages in reduction gear case; also spray nozzle, and governor pressure oil through propeller shaft when hydraulic propeller is used.
26. Relationship of Oil Pump, Oil Strainer and Pressure Relief Valve: Arrows indicate flow of oil from the pressure pump through check valve to oil strainer (Located at inlet to engine system), and operation of the pressure relief valve by a balance line from the outlet of the oil strainer.
27. F-2L Timing Chart: This chart of F-2L timing shows the duration of each of the four strokes, the valve timing and ignition timing. Also shown are the direction of rotation of the crankshaft and some of the drives.

28. FR and E Timing Chart: This chart is the same as the foregoing one, except that the difference in direction of crankshaft and starter rotation will be noted. All the other drives retain the same direction of rotation.
29. C-15 Timing Chart: It will be noted that because of an internal reduction gear the C-15 crankshaft and propeller shaft rotate in the same direction.
30. Fuel Characteristics at Altitude: This graph shows boiling point decrease with an increase in altitude -- a noteworthy point to be considered in high-altitude operation.
31. Stromberg Injection Type Carburetor: Show chambers, diaphragms, fuel pressure lines, metered fuel lines and discharge nozzle unit.
32. Curtiss P-40D and E Instrument Panel and Controls: Reference key indicates location of various engine instruments and controls.
33. Bell P-39F Instrument Panel and Controls: Reference key indicates location of various engine instruments and controls.
34. Lockheed P-38E Instrument Panel and Controls: Reference key indicates location of various engine instruments and controls. These instrument panel photos can be used for instruction in proper starting, operation and stopping of engines in these planes.
35. Turbo Supercharger and Regulator: Colored arrows indicate exhaust gas and fuel-air flow through turbo unit, and flow of free air for cooling. Black arrows and notes describe operation of regulator and its connection with throttle lever in cockpit.
36. F-3R Engine, Showing Accessories and Connections: In this view we see the principal external components of the F-3 engine, with accessory locations and connections.

Indicate location of -

Accessory housing
Carburetor
Distributor
Ignition harness

Spark plugs
Exhaust ports
Reduction gear
Crankcase - upper and lower
halves, and oil pan

37. Manifold Pressure Regulator: The Automatic Manifold Pressure Regulator is more commonly called the Automatic Boost Control.

The function of the Boost Control is to relieve the pilot of the necessity of constantly controlling manifold pressure by throttle manipulation with every change in altitude. The necessity of this manipulation was formerly a great handicap to the combat pilot, but is now overcome by this mechanism which automatically maintains the desired manifold pressure, throughout the altitude range of the engine.

38. Piston Ring Placement Diagram: This chart shows proper placement and clearances on the C., E. and F. engines.
39. Engine Cross-Section: This chart shows a cross section through No. 6 cylinders.

Harold Ellis.

7-17-43